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IN THIS ISSUE:

RAILS AND RAILROADS
THE BRITISH FLEET TODAY

SCIENTIFIC AMERICAN

A Weekly Review of Progress in
INDUSTRY • SCIENCE • INVENTION • MECHANICS



LOGGING WITH THE AID OF THE ELECTRIC YARDER AND DUPLEX LOADER.—[See page 285]

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"Medium" Oil from Nine Garages

And no two alike!

The high cost of asking merely for "light," "medium" or "heavy" oil

A MOTORIST bought nine separate quarts of oil from nine garages. In each case he asked for a quart of "medium" oil. The samples were sent to us for analysis.

No two tested alike, either in body or character.

A vital point in automobile lubrication is involved.

Assume that one of these "medium" oils was correct for that man's car. Then in body the other eight were certainly incorrect. Their use would lead to wasted gasoline, wasted oil, loss of power and all the effects of incorrect lubrication.

One manufacturer's "light" is often another's "medium." A third manufacturer's "medium" may be a fourth manufacturer's "heavy." No central authority sets definite standards for oils so classed.

Furthermore: Under the heat of service many so-called "heavy" oils become thinner than many so-called "medium" grades.

The motorist who buys oil in this hit-or-miss way is certain to

get hit-or-miss compression and hit-or-miss protection.

WE PRODUCE Gargoyle Mobiloils in several grades. We mark these grades with letters or symbols—"A", "B", "E", "Arctic." The grade which is of the correct body and character for your car is plainly indicated on our Chart of Automobile Recommendations. To use any other grade of Gargoyle Mobiloils than that specified for your car in the Chart is a mistake.

When you use the grade of Gargoyle Mobiloils specified for your car in the Chart, the oil in your crank-case does not vary from day to day or week to week. You get uniform protection, full compression and consistent performance. You get true economy of upkeep and operating costs.

To buy your oil in any other way is to invite wasted gasoline and other unnecessary expenses.

If your car is not listed on the partial Chart to the right, send for our booklet "Correct Automobile Lubrication," which contains the complete Chart. Or consult the complete Chart at your dealer's.

In writing, please address our nearest branch.



Mobiloils

A grade for each type of motor

Chart of Recommendations for AUTOMOBILES (Abbreviated Edition)



Mobiloils

A grade for each type of motor

How to Read the Chart

THE Correct Grades of Gargoyle Mobiloils for engine lubrication are specified in the Chart below.

A means Gargoyle Mobiloil "A"

B means Gargoyle Mobiloil "B"

E means Gargoyle Mobiloil "E"

Arct means Gargoyle Mobiloil Arctic

These recommendations cover all models of both passenger and commercial vehicles unless otherwise specified.

Where different grades of Gargoyle Mobiloils are recommended for summer and winter use, the winter recommendation should be followed during the entire period when freezing temperatures may be experienced.

This Chart is compiled by the Vacuum Oil Company's Board of Automotive Engineers, and constitutes a scientific guide to Correct Automobile Lubrication.

If your car is not listed in this partial chart consult the Chart of Recommendations at your dealer's, or send for booklet, "Correct Lubrication," which lists the Correct Grades for all cars.

NAMES OF AUTOMOBILES AND MOTOR TRUCKS	1920		1919		1918		1917		1916	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Allen	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Buick	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Cadillac	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Chalmers (6-48)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
All Other Models										
Chandler Six	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Chevrolet (8 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(7 & 1 Ton)										
Cleveland	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Cummins	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Dart (2 1/2 Ton)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
All Other Models										
DeSoto (Model U)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
All Other Models										
Diamond T (1 1/4 Ton)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Mod. 1 1/2 Ton & K 1 1/2 Ton										
All Other Models										
Dodge Brothers	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Duesenberg	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Elcar (8 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(8 cylinder)										
Emery	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Federal (Model S-3)										
(Special)										
All Other Models										
Ford	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Four Wheel Drive	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Franklin	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Giant (Using Gasoline)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(Using Kerosene)										
Grant (5 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(Cub) Model 12										
All Other Models										
Harrison	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Hupmobile (6 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(12 cylinder)										
Holmes	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Hudson Super Six	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
All Other Models										
Huynh	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
T. 12 (12 cylinder)										
International	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Jordan	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Long (8 cylinder)										
Kaiser (Model 48)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(12 cylinder)										
All Other Models										
Lea	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Leocomobile	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Marmon	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Maxwell	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Mercury	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Minneapolis (6 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(8 cylinder)										
Maline-Knight	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Nash (Quad)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Model 471										
All Other Models										
National (6 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(12 cylinder)										
Nelson	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Oakland (8 cylinder)										
All Other Models										
Oakville (4 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(8 cylinder)										
Oxley (5 Ton)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
All Other Models										
Overland	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Packard	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Pontiac (8 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(Cant. Eng.)										
Parker	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Perkins (12 cylinder)										
All Other Models										
Pierce Arrow	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(Com.) (5 Ton)										
All Other Models										
Pontiac	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(Com.) All Other Models										
Prentiss	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
R & V Knight										
Reno	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(14 Ton)										
(11 Ton)										
(Com.) All Other Models										
Riley	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Model B A										
All Other Models										
Rock Falls	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Saxon	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Scotch-Booth (6 cylinder)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(8 & 12 cylinder)										
Standard Com'l. (Detroit)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Stearns-Knight	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Stirling (Milwaukee)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Studebaker	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Sueta	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Temple	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Wells (Model 34)	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
(8 cylinder)										
(Com.) (16 Ton)										
All Other Models										
Westcott	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
White (16 valve)										
(12 Ton)										
All Other Models										
Willys-Knight	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Willys Six	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Winton	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct
Woods	A	Arct	A	Arct	A	Arct	A	Arct	A	Arct

VACUUM OIL COMPANY

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SEVENTY-SEVENTH YEAR

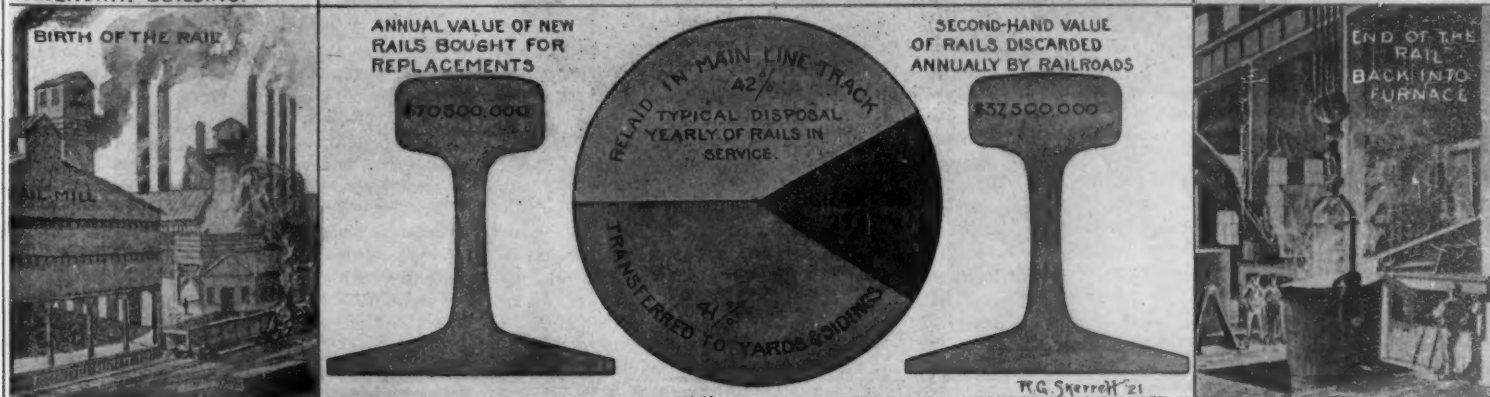
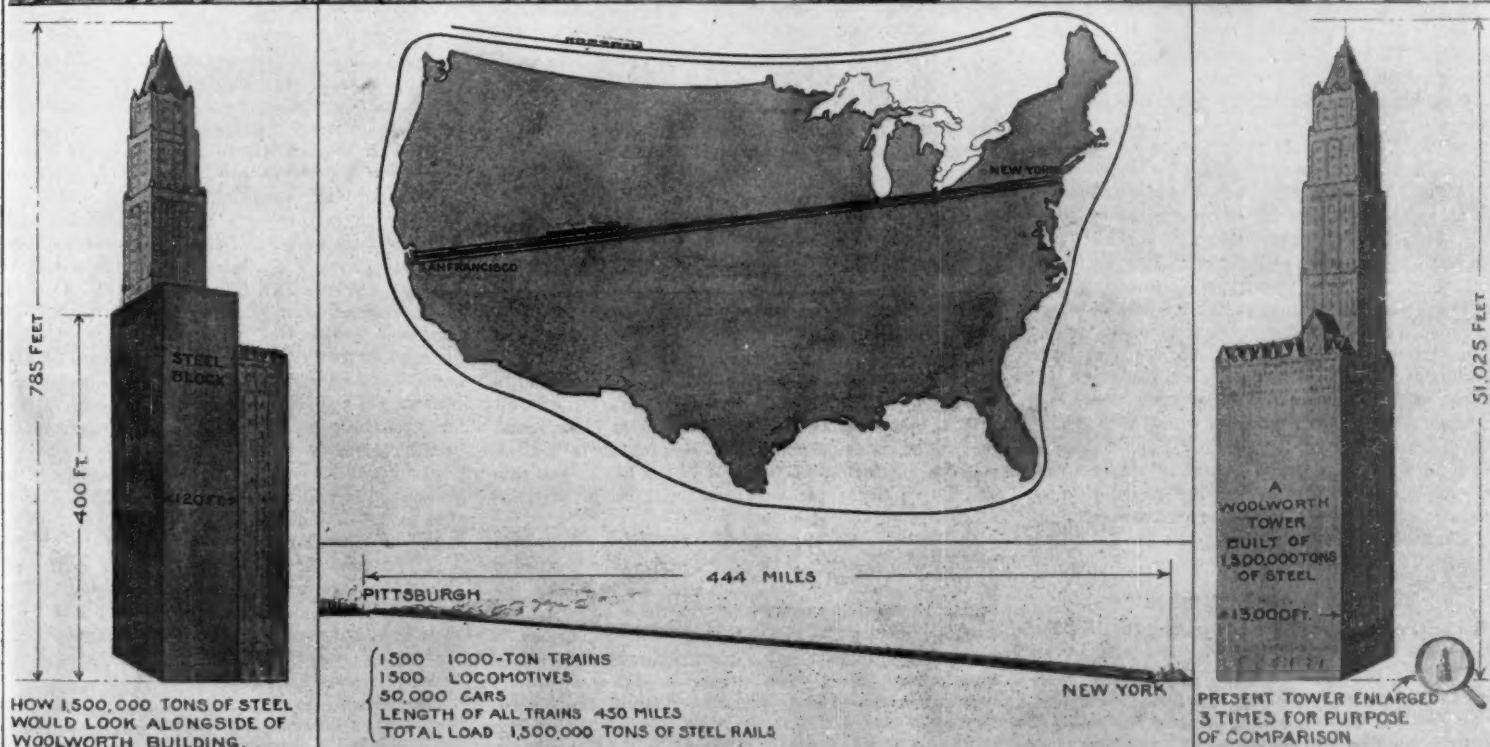
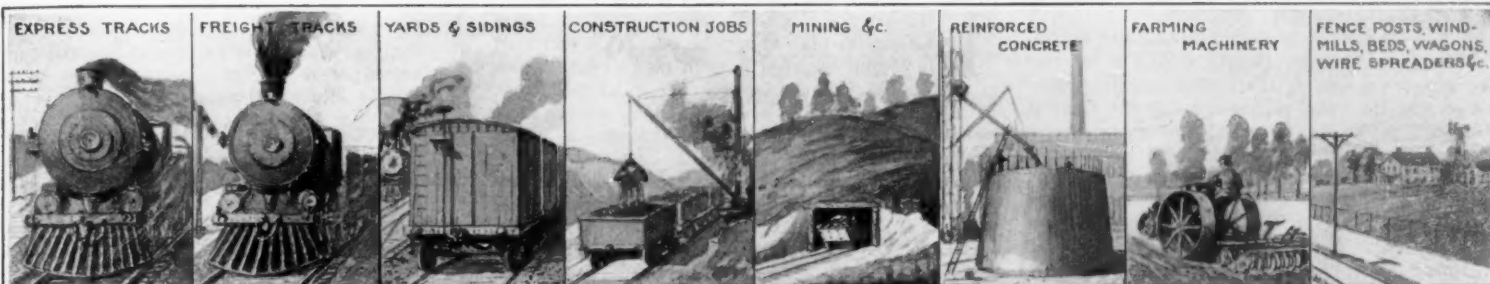
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The top row of pictures shows the life history of a typical steel rail from the time it is pressed into service on the main line of a railroad, until it terminates its career in such forms as fence posts, windmills, beds, wagons, wire spreaders and so on. The map of the United States shows the mileage represented by our annually relaid tracks—sufficient mileage to make three and a fraction tracks across the United States, or sufficient mileage to go around the United States with a good deal to spare. The comparison given below the map shows how many cars and locomotives would be necessary to move 1,500,000 tons of new steel rails. Other drawings show the volume of steel involved in this work in comparison with the Woolworth Building.

The story of the steel rail of American railroads and the yearly traffic in new and old rails—[See page 287]

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Army Engineers Report Against Ocean Ship Canal

THE Chief of Engineers of the Army was ordered in the River and Harbor Act of 1919 to report on the feasibility of an ocean ship canal between the Great Lakes and the Hudson River. After investigation, the Army Engineers having charge of the survey have reported against the project and the report is endorsed by the Chief of Engineers, Major General L. H. Beach.

This is no new subject. It has been investigated many times since the first report was made in 1832. There are three practical locations between Lakes Erie and Ontario, namely, the Welland Canal in Canada, and in America, the routes from Tonawanda to Olcott and from LaSalle to Lewiston. Between Ontario and the Hudson River a ship channel could be dug along the route of the existing New York State Barge Canal from Oswego to the Mohawk Valley, and down the Valley to the Hudson, or from the St. Lawrence to Lake Champlain and thence by ship canal to the Hudson.

General Beach states that the value of a ship canal depends mainly upon how much of the present hundred million tons of Lake commerce would be moved through the canal, and what saving of freight charges would be effected. He reaches the conclusion that it is not feasible for the United States to build such a canal at the present time. He considers that the present State Barge Canal has not been open for navigation a sufficient time for business interests to accommodate themselves to its use, and that as yet it is too early to determine definitely what its commercial influence will be. The 160 million dollars spent upon the Barge Canal would be lost if a ship canal were built. Therefore he recommends that any consideration of the construction of a deep-sea canal be abandoned until the actual completion and use of the large Welland Canal, and the actual demonstration of the inadequacy of the New York State Barge Canal, indicate a need for such a ship canal.

The Battle of the Brakes

FRANCE has been the scene during the last few weeks of a contest between the leading types of train brakes in which our own Westinghouse brake has been a leading factor and promises, indeed, to be the deciding factor. The ever-increasing power of locomotives and length of trains developed a problem of train braking which became so serious as to demand a quick solution. The older type of pneumatic air brake was set by the opening of a continuous train pipe which extended throughout the train. This reduced the air pressure and allowed the brakes to function. The release was effected by the engineer at the head of the train and while the brakes were supposed to be set simultaneously, as a matter of fact, the reduction of air pressure was gradual from the front to the rear of the train, the brakes being successively set at very slight intervals of time. This was not serious in the shorter trains of an earlier period, but when trains began to run to lengths of 35 to 60 cars, trouble developed. The momentum of the unbraked after-portion of the train brought excessive strain upon the center cars, and occasionally would cause the buckling of the train and derailment. The trouble was remedied by introducing the pneumatic-electric brake by which the engineer was able to open the train pipe at each car simultaneously.

The French Government has instituted a competition with a view to selecting a standard type of brake for all the governmental railroads. The Westinghouse

brake has been used for many years on that splendid system known as the Paris, Lyons and Mediterranean Railroad. It has proved entirely satisfactory. This experience has been confirmed in the tests which have been recently held. The closest competitor is the type of brake which has been used successfully on the Paris subways; but it is stated that when the brake was tried out on a long mixed freight train running at fifty miles an hour, several cars were injured. The German Kunz Knorr brake, which is used on several of the German railroads that cross the frontier is not adapted for use with the Westinghouse and other types of brake, and trains crossing into France have to use the hand brake. It is believed in France that the adoption in that country of the Westinghouse brake will lead to its use in Germany and ultimately throughout Europe.

Ships Stay Too Long in Port

THE average man thinks of a ship as engaged in sailing the high seas, with occasional and brief interruptions when it is in port. Quite a mistaken idea; for the average ship spends as much time in port as she does at sea. Indeed, in times of depression such as we are now passing through, she spends much more of her time in port than at sea.

Since a ship is a means of getting goods from one place to another, she is in a sense profitably employed only when she is moving as her receipts are in proportion to the distance over which these goods are moved. Since all the overhead and crew charges continue to accumulate while the ship is in port, manifestly everything possible should be done to cut down the time spent in loading and unloading and in the necessary ship repairs. For lack of a sense of proportion men have busied themselves with one-half of the problem to the neglect of the other half. We have given most of our effort to perfecting the ship and too little to perfecting the pier, dock, warehouse and mechanical appliances which determine the length of time the ship spends in port.

In this connection much interest attaches to a paper on the functions of the merchant ship, read at the last meeting of the Institution of Naval Architects by Sir Norman Hill, in which he protests against the statement that time in port is lost time, pointing out that loading and discharging are just as necessary as the transportation of cargoes—a fact which ought to be self-evident. He makes the point that the over-all efficiency of a ship is composed of several factors, and that, after safety, the most important of these is time, since in measuring efficiency, it is the life of the ship and the total of the cargo she will carry that are always to be kept in view.

In endeavoring to gain this efficiency, the naval architect must have in view first safety, for commerce profits nothing from lost cargoes. As to speed, the author of the paper argues that little is to be gained from increasing the speed with which any voyage is made; and he brings out the surprising fact that during the past thirty years there has been a negligible increase in the average speed of ships of the British mercantile marine. Lloyd's statistics show that the average speed of vessels of twelve knots and upward was 13.9 knots in 1894, and in 1908, when the tonnage had nearly tripled, the average was only 14 knots. The average speed of all ships, fast and slow, is estimated to have been in 1894, 10.4 knots and in 1908, 11 knots. Altogether, the author of the paper believes that the average speed of British steamships has not increased during the past thirty years more than about half a knot.

Evidently, if any considerable amount of time is to be saved it must be saved in port.

Although much has been done in the design of loading and unloading machinery, particularly for ships carrying freight in bulk, for ships carrying special commodities and mixed freight there is still room for great improvement. In studying the problem, certain tendencies are to be noted. First, there is the growth in size of the ocean-going steamship. In 1860, the average size of the British steamship was 2,200 tons gross. In 1890 it was only 2,600 tons; but in the next ten years it increased to 3,500 tons, and in 1910 it was 4,000 tons. Undoubtedly, today it is very much larger. There is to be noted a concentration of trade in a limited number of ports, of which London and New

York are the most marked examples. Another tendency—very important as affecting expeditious handling of cargo—is the growth of what is called "parcel shipments," and the decrease of "whole cargoes." General trade both import and export is depending more and more on the liners which carry mixed cargoes. Safety and regularity of voyages enable the manufacturer and retailer to buy almost direct from the producers in all parts of the world. International trade is carried on borrowed money, and while in transit almost all cargoes are the properties of the bankers and financial houses. The effect of all these tendencies is to concentrate the general ocean overseas trade in the ports which can offer the best accommodations to the bigger ships, both as regards berthing and the handling of their mixed cargoes. Unfortunately, as regards the length of stay in port, this concentration works against the quick turn-around of these ships. These observations have a decided significance for the leading ports of our own seaboard, where the same causes will increasingly produce the same results when the present depression passes and trade begins to flow in volume through its accustomed channels.

Results in Our Reclamation Service

IT is now some eighteen years since the Reclamation Act for the recovery of the semi-arid lands of the West was passed; and although the work was planned on an unprecedented scale of magnitude, progress has been uninterrupted and the economic results as shown in the last report of the Secretary of the Interior are highly satisfactory. To date twenty-four primary and four Indian projects have been completed, or partly completed, at a net cost of 125 million dollars; and in the fiscal year ending June 30, 1920, the value of the crops grown on these projects amounted to 153 million dollars.

Although the great fertility of the lands thus recovered by irrigation is proverbial, the following statement of the yields per acre in the various districts will be surprising to anyone who is not familiar with the details. Thus we learn from the report that the crop values in excess of one hundred dollars per acre are as follows: In the Salt River project, \$126.27; Yuma, \$134; Yakima, Sunnyside Unit, \$167.07; and on the Okanogan project the yield reached the astonishing figure of \$367.23. The annual farm census of the Reclamation Service shows that the value of products on reclamation projects of nearly \$80 per acre is twice as large as the average yield of unirrigated land in the humid regions of the United States.

The statistics of increase show that there was a growth of irrigated acreage of from 694,142 acres in 1913 to 1,187,255 acres in 1919. In the same period the crop value has risen from \$15,676,411 to \$88,974,137. A serious problem has developed in the matter of providing adequate drainage to prevent seeping and water-logging of the soil and the deposition of alkali. It can be solved; but we learn that a considerable portion of the funds must be employed in the construction of drainage work.

The wisdom with which the scope and plan of operations of this great Federal work were planned is shown in the case of the Salt River project, which reported a total crop value of 23 million dollars. This is twice what the Water Users' Association must repay to the United States over a period of twenty years; moreover, most of this money will be derived from the power profits from the various hydroelectric works that form part of the system. On other projects the actual crop value is comparable to the cost of building the irrigation works which have made these crops possible.

The proportional distribution of the crops places alfalfa in the lead with 40 per cent of the cropped acreage. Next is wheat with 15 per cent. Pastures represent 10.3 and cotton 9.7 per cent. In spite of this favorable showing, it has been impossible to undertake new projects because of the lack of funds.

The shortage of funds is due, in part, to the falling off in the receipts from the sale of public land. Another drawback has been the setting aside (as provided by the Act) of \$1,000,000 annually to repay advances made from the revolving fund of \$20,000,000. However, it is probable that many millions of dollars will be transferred to the Reclamation Service, in accordance with the Act of Feb. 25, 1920, covering the leasing of mineral lands.

Electricity

An Electric Egg Beater is the latest electrical appliance for the home. This device consists of a small electric motor which drives a pair of blades through suitable gearing. The device is provided with a handle so that it can be conveniently handled and tilted to any angle. A control lever starts and stops the motor, and regulates the speed of the blades or paddles as required. The gears and bearings are of bronze.

An Electric Invalid Chair has been developed in France with specifications as follows: $\frac{1}{4}$ -horsepower electric motor, controller which provides four speeds forward and reverse, worm drive to front wheels, special leaf and C springs, pneumatic-tired wire wheels, and storage battery with a capacity of 20 ampere hours. Particular attention has been given to suspension. This chair has been produced to replace the manually-driven type, and in consequence of the demand for invalid chairs for war invalids.

Reproducing Speech with Galena Crystals.—As far back as 1913 Brazier and Dongier showed that the passage of a sufficiently strong alternating current across the surface of contact of a metal point with a crystal of galena caused a sonorous effect. P. Collet, writing in *Comptes Rendus*, tells of his experiments along this line. By using an undamped wave arrangement and a primary and secondary circuit properly tuned and including a microphone, he has been successful in reproducing the singing voice with the galena contact. The phenomenon is attributed to thermal effects.

Copper-Clad Steel Wire is made by casting molten copper about a specially treated round billet, carefully centered in a round mold. The composite billet is subsequently hot rolled to a wire rod, and then cold drawn to copper-clad steel wire. The coextension of the two metals is said to be equal, and the per cent of coating remains the same at all stages of manufacture. Bending, twisting, stretching and breaking the wire only proves that the copper coating is practically homogeneous with the steel core. It is also claimed that the copper-clad wire is 50 per cent stronger than galvanized wire and 60 per cent stronger than solid copper wire of the same section.

Northolt Radio Station.—With an aerial system consisting of a triangular network, each side of which will be 650 feet in length, the Northolt station, quite close to London, is now nearing completion. The aerial will be supported by three wooden lattice towers, each 446 feet high. The transmitting equipment will consist of Elwell-Poulsen exciter generators fitted with remote control. In the near future a valve set, employing the high-power Mullard silica valves will also be installed. Although the output to the aerial is 50 amperes or more, this station will be operated directly from the Central Telegraph Office in London, at speeds of about 60 words per minute; but provision has been made for the installation of high-speed signaling at more than 100 words per minute.

New York's Wireless Fog Signals.—The Secretary of Commerce has announced that in view of the important development of a radio compass by the Bureau of Standards, three wireless fog signals would be immediately installed at the entrance to New York Harbor through the Lighthouse Service. Each of these three stations is equipped with an automatic radio set sending out signals continuously during fog or thick weather. They may be picked up on shipboard by means of the new radio compass which indicates the direction from which the radio signals are sent out, and by taking observations on the different stations the captain of a vessel may determine his exact position without being obliged to rely on the former unsatisfactory method of locating himself by the sound of whistles and fog horns.

Fatal Electric Shock.—In a Vienna workshop an electric freight elevator operator was found dead on his seat, evidently from shock. On examination the cause of the accident was traced to defective contact on the electric safety device which prevents the elevator motor operating until the iron elevator door is closed. The seat and its framework are grounded and, therefore, a voltage exists between these and the individual phases of the 220-volt three-phase supply, which, according to the state of insulation of the whole system often nearly approaches 200 volts. The iron elevator doors are not grounded. Owing to the defective contact, the iron door in closing became alive, and thus a voltage existed between it and the operator's seat, which was the cause of the man's death. The accident proves the importance of grounding all ironwork used in conjunction with electrical apparatus, irrespective of voltage, particularly where alternating current is employed.

Astronomy

Seeking an Observatory Site.—Prof. Benjamin Boss and Dr. R. E. Wilson have recently made a tour of the southwestern United States, in search of a place offering the best optical conditions for a new station of the Department of Meridian Astronomy of the Carnegie Institution of Washington.

Radial Velocity of the Greater Magellanic Cloud.—According to observations made by R. E. Wilson from Cerro San Cristobal, and reported by the Lick Observatory, on 17 bright-line nebulae in the Greater Magellanic Cloud, the cloud as a whole appears to be moving with high velocity away from our system.

Astronomical Computing.—The British Astronomical Association has organized a Computing Section, under the direction of L. J. Comrie. The function of this section will be to carry out more or less extensive calculations required by the other sections of the association, and also to prepare tables, predictions, etc.

Comet Taylor-Skjellerup.—With regard to the published announcements of the discovery of a comet by Skjellerup, at Cape Town, on Dec. 11, 1920, it now appears that the new comet was first seen by Clement J. Taylor, of Cape Town, on Dec. 8, but on account of an error on his part in reading the hour circle of his telescope, the discovery was not verified until after the independent discovery of the comet by Skjellerup. Dr. Crommelin, who has communicated the foregoing information to the International Bureau of Astronomical Telegrams, proposes that the comet be called Comet Taylor-Skjellerup.

Neptune's Satellite.—The current annual report of the U. S. Naval Observatory records the progress that has been made in an investigation of the orbit of Neptune's satellite, begun by the late Professor Newcomb shortly before his death. Forty-six sets of observations, covering the period from 1889 to 1908, are under discussion. Of these 13 were made by photography at three different observatories, and 33 visually by 13 different observers at six different observatories. Corrections to the elements have been obtained from 26 of these sets of observations, and the normal equations are ready for solution for 9 other sets.

The Total Lunar Eclipse of April 21-22 will be visible throughout the United States. The moon is north of the center of the earth's shadow, but nevertheless near enough to it to become completely immersed. At 11:57 P. M. on the 21st the moon first touches the penumbra, but it will not be till well after midnight that the darkening becomes conspicuous. At 1:03 A. M. the edge of the true shadow is reached, and more and more of the moon will be hidden until, at 2:23 it is completely obscured except for the faint reddish light refracted through the earth's atmosphere. Totality lasts only 42 minutes, and the moon is entirely clear of the shadow at 4:26 though it does not leave the penumbra until 5:22. The bright star Spica will be within 10 degrees of the eclipsed moon, making a very pretty spectacle for anyone who gets up to see it.

Solar Eclipse of Sept. 10, 1923.—Various preliminaries are already under way for the observation of the total solar eclipse of Sept. 10, 1923, the path of totality of which extends across Mexico. The Mexican government has established a number of temporary meteorological stations along the path for the purpose of collecting data of cloudiness during the first 20 days of September, beginning with 1919. These data, together with a large-scale chart of the region in question, will be published in 1922 and distributed to observatories throughout the world. According to Director J. Gallo, of the Tacubaya Observatory, the only good place for an eclipse station in Lower California is Ensenada de Todos Santos. Tampico is in the path of totality but not near the central line. The harbor of Champoton, in the peninsula of Yucatan, is unfavorable climatically, and totality here is very short.

Preparing for Solar Eclipses.—The Eclipse Committee of the American Astronomical Society has made a report on the arrangements now under way for observing the solar eclipse of Sept. 20, 1922, in Queensland, and that of Sept. 10, 1923, in Mexico. A part of the program consists of obtaining meteorological observations along the path of the eclipse in the years preceding its occurrence, not merely at the corresponding season of the year, but also at the hour of the eclipse, so as to take account of the variations of cloudiness with the time of day. When sufficient data for the two eclipses are available, the committee will publish the same for the benefit of intending observers. The committee will also suggest lines of work most needed, serve as a clearing-house in arranging for loans of instruments and apparatus, and compile a list of proposed expeditions in connection with the Mexican eclipse.

Engineering

Live and Dead Lumber.—A report issued by the Forest Products Laboratory states that if sound dead trees are sawn into lumber and the weathered or charred outside cut away, such lumber cannot be distinguished by any known tests from that cut from live trees. Most of the wood in a live tree is actually dead, and the specification for lumber should therefore be framed to provide for a maximum amount of decay or insect infestation, and the provision of a clause specifying live timber is unnecessary.

Hydro-Electric Development in France.—A recent publication on the development of water power in France states that prior to August, 1914, the amount of hydroelectric power developed amounted to 750,000 horsepower out of an available total of 8,000,000 to 9,000,000 horsepower. By the middle of 1919 it is stated that France was equipped to develop 1,165,000 horsepower, furnishing an average of approximately 770,000 horsepower. At that time more than 500,000 horsepower was being developed, and it is estimated that in 1934 an average of more than 4,000,000 horsepower will be reached.

Colorado River Power Project.—Further details concerning the scope of the extensive hydroelectric project of the Southern California Edison Company, whereby it is proposed to develop 2,500,000 horsepower of electrical energy from sites on the Colorado River outside of the National Park, indicate that in the development of water power of the Colorado River the installations must be made in large units and at such intervals as the demand for power will justify additions of from 100,000 to 200,000 horsepower. The *Electrical Review* points out that development in small units would involve greater cost per horsepower, resulting in higher charges to consumers.

Stone Screenings.—Recent tests conducted in Montreal indicate that appreciable increases in the strength of concrete may be obtained by the judicious use of stone screenings in the aggregate, or by the substitution of finely-crushed stone for ordinary sand. Some of the results showed that as much as 22 per cent additional strength was secured by admixing stone screenings to the extent of 5 per cent of the weight of the aggregate in a given mixture, continues the *Times Engineering Supplement*, while in the case of mortar, where ordinary sand had been replaced by crusher sand, increases in strength from 15 per cent up to 70 per cent were observed in test specimens.

Substitute Cross Ties.—The task of finding an efficient substitute for timber ties resulted partly from a fear of impending shortage of timber, and the only substitute made and used on a commercial scale is the I-beam section of a leading American steel mill. These ties, we learn from the American Railroad Association, are efficient on non-insulated tracks under heavy and dense traffic, and the line, surface, and gage can be preserved at reasonable expense. Corrosion is, however, a serious factor, and insulation is a problem which has yet to be satisfactorily solved. Other substitutes such as steel and concrete or steel and wood have been tried, and some of these show promise of success.

Delaware River Power Plan.—Announcement of a proposed plan to develop about 500,000 kilowatts in water power on the Delaware River, at a total cost estimated at \$200,000,000, appears in a recent issue of *Electrical World*. Active work will be commenced as soon as authorization is received from the Federal Water Power Commission. The plan calls for the construction of four dams, at or near Belvidere, Bushkill, Shohola and Butler's Rift, with an average head of 80 feet. The total power capacity of these four dams is estimated at about 500,000 kilowatts at normal high water. In addition, a steam power plant with a capacity of 100,000 kilowatts will be erected somewhere in New Jersey in order to supplement the hydroelectric plant during seasons of low water.

Havre Port Undertaking.—A large job is about to be undertaken in connection with the deepening of the outer harbor of the French port of Le Havre. The scheme includes erecting and working, on both north and sides of the outer harbor, transshipping berths, wharves, mooring buoys, raised earthworks, roadways, a dock for petroleum, gasoline and other inflammable hydrocarbons, a complete plant comprising both quayside and floating equipment for handling general goods, coal, heavy oils, petroleum, and gasoline, together with goods sheds, tanks and machinery; likewise, rails running along the quays and joining with the State railway. It appears very much as though the French were going to make a strong bid for the world's shipping, judging by this and other extensive improvements in French ports.

Uncle Sam's Artificial Fish

The Hatchery Work of the United States Forest Service

By S. R. Winters

ADMINISTRATION of 151 National forests, representing an area of 153,933,460 acres; conservation of timberlands, and the reforestation of depleted woodlands, are among the duties commonly ascribed to the United States Forest Service. Rarely would one visualize this Federal Government bureau functioning as operator of fish hatcheries, collecting trout eggs from streams of plenty and distributing them in much frequented mountain waters as a surety that the proverbial fisherman's luck will not prevail. The popular species of trout constitute a valuable resource of these National playgrounds and clearly it is within the province of Uncle Sam to safeguard the supply and aid Nature in replenishing the haunts of the sportsman.

Colorado is a favorite trysting place of anglers, where mountain streams and lakes yield unstintingly of their supply of rainbow, native or black-spotted, and eastern brook or red-speckled trout. The opportunities for the beautiful rainbow trout beckon without restraint, earning for this region the justly-bestowed designation of "The Fisherman's Paradise." Yet Nature is impotent to make continuous and positive this phrase which cannot fail to engage the consuming interest of real anglers. Unless restocked these mountain waters would have their supply of fish well-nigh exhausted within a few seasons. Clearly, artificial propagation is to be desired, a need generously responded to by the State Fish and Game Commission of Colorado

in the stream of their acclimation until they are "ripe." Frequently, environments and the formations of the lakes preclude this. Consequently, the trout are assembled and concentrated into a so-called "ripening pen." The latter may constitute a section of the creek, arranged into a trap by stretching wire netting above and below a specified point—from 20 to 25 feet apart. The fish are retained in these quarters from two to three days, the time allotted for females to ripen and subsequently yield their eggs. Spawn work is done in the afternoon.

The fish are removed from the ripening pen with a seine or by use of a dip-net, being transplanted to wash tubs containing water. Then they are conveyed to a stripping bench. Here, working under an awning, an individual isolates one fish at a time from the tub, holds it with the tail removed from his body, and strips the eggs by moving his forefinger down the side of the fish, from head to tail. Only a few brief seconds intervene, the fish having been robbed of its eggs is deposited in the stream where former and natural habits of life may be renewed. Eggs thus obtained from the female fish are caught in an ordinary tin milk pan, subsequently being fertilized with "melt" or "milk" from the male member of the family. Obviously, eggs freshly stripped are flabby and are inclined to form a mass. Soon, however, the specimens begin to consume water and gradually become isolated into units. Once separated,

a strip of damp cheesecloth about ten inches square. The eggs, having hardened, are dipped from the retaining pail with a measuring cup having a capacity for 4,000 eggs. They are poured on to the cheesecloth which is forthwith folded over the eggs, and then covered with another layer of moss. Having filled all the trays they are inserted in a wooden case. A tin tray with holes in the bottom is packed full of ice or snow and is placed on top of the fish-egg trays. The bottom of the compartment trays being a fine mesh the water from the melting snow or ice seeps its way through the moss and cloth, thus penetrating all portions of the container. The eggs are thus surrounded by a cool atmosphere, insuring their soundness until they reach the hatchery. If a considerable distance is to be covered, ice or snow is renewed in the tin container at frequent intervals. A maximum time limit of ten days is fixed for the preservation of the eggs when subjected to these shipping conditions, abrupt jarring being studiously avoided.

Eggs taken at Trappers Lake are packed on horses and conveyed to Marvins, 16 miles distant; thence by automobile to Rifle, 75 miles, and shipped by railway to Denver or other hatcheries—the distance ranging from 75 to 300 miles. Upon being received at the hatchery, the eggs are placed on wire-bottom screens, 12 by 14 inches in dimension. These are soured in troughs of running water, preferably spring water. At a temper-



Left: Taking fish from the ripening pen, when the females are "stripped" for their eggs. Center: The equipment used for shipping the eggs. The filled compartment holds 4,000 future trout; the white substance in the pans is snow for refrigerating purposes. Right: A close-up of the stripping process, by which 400 to 600 eggs are obtained from each female fish

Where the Federal fish hatcheries get their raw material

and the United States Forest Service—17 National forests enveloping the mountainous area of the State. A score of hatcheries are maintained, yielding 15,000,000 fry for restocking the waters where the disciples of Izak Walton never tire of their ancient and pleasurable pursuit.

A peculiar quirk in Nature, it would seem, is that from 75 to 90 per cent of the eggs hatch under the fondling care of man, whereas but two to four per cent are transformed into fish when left to develop naturally. This interesting observation, vouchsafed by fish and game experts, suggests the opportunity of unfolding the details involved in the novel procedure of transplanting trout from a region of abundance to streams where the supply is constantly being subtracted from by fishermen. Trout spawn in moving water wherever feasible, either in a stream or at the inlet of a lake. The rainbow trout usually spawn in May; the native trout defer the process resulting in the multiplication of their kind until July; while the eastern brook trout, in their tardiness, spawn in October or November. Individuals employed in collecting eggs capture the fish in the lakes high in the mountains. And here it may be noted that every official of the Forest Service is a deputy game warden and the protection of wild life and fish propagation suggest a special responsibility.

Inlets to lakes are invaded for fish in gathering eggs for propagation purposes. Veterans of the reel and rod claim that trout thus assembled should remain

rated, they are drenched in running water and left in a cool place for one hour where they swell and harden.

The housewife who carries her hen eggs in a basket by the dozen to the crossroads store may be contributing to a consignment of poultry products destined for a journey across the continent. Similarly, fish eggs are not used at the point of collection. The Forest Service distributes 3,000,000 eggs to 150 different streams and lakes in Colorado. Millions of additional fry are transplanted by the State, railroads, and private individuals in the waters coursing through the National forests. The eggs are shipped from Trappers and Marvins Lakes to the Glenwood Springs and Buena Vista hatcheries and likewise to Denver for distribution to nearby hatcheries. A small hatchery is maintained at Trappers Lake, yielding from 600,000 to 700,000 fry.

The ingenuity of man which enhances the productive capacity of fish eggs from 4 to 90 per cent likewise devises an efficient method of transporting consignments far removed from the originating point. Wooden cases are employed, each unit comprising four egg trays and an ice container. The egg trays resolve themselves into ten compartments each, $3\frac{1}{2}$ by $3\frac{1}{2}$ inches in dimension. Each compartment has a capacity for 4,000 eggs or 40,000 to the tray—equivalent to 160,000 eggs to the case. Wet moss, placed on the bottom of each compartment, gives a downy bed for the products. The moss, gathered from a nearby stream, is reinforced by

ature of 50 degrees, the eggs develop eyes in 25 days, and complete the transformation in from 45 to 50 days. If the water is warmer, the time required for hatching is less—approximately, each degree of heat curtailing three days from the hatching period. The young fish, when first hatched, possess a food-sac attached to the under portion of the body. Until this formation is absorbed, after an elapse of 20 days, they reject all food. With the obliteration of this growth, finely-pulverized liver is devoured with relish.

The young fry are shipped from the hatchery for planting in streams and lakes when an inch or more in length. The well-known cannibalistic tendencies of large fish to devour the offspring of the species will not permit of the release of the fry from the retaining pond until they have attained the fingerling stage. Having developed some size, the fry is able to withstand the law of the survival of the fittest as it applies to streams inhabited by fish when existence is perpetuated by devouring their kind. Brook trout are transplanted from cultural conditions to the mountain waters in the spring while rainbow trout change their environment during the fall months. Observations in the propagation of trout in the National forests serve to explode the theory that fish will develop fungus or die if handled. Wet hands will obviate any ill effects that may be threatened by fondling the finny tribe. To illustrate, at Trappers Lake 10,000 fish come in contact with wet hands and no trouble has appeared.



Left: Electric yarder and duplex loader mounted on sled. Right: Induction motor for direct drive of wood saws

Electrically-operated equipment of the logging industry

Logging by Electricity

By Alfred Longville

OVERCOMING seemingly insurmountable obstacles, a logging company operating in the States of Washington and Oregon has demonstrated the value of electricity in felling timber. For the first time, perhaps, in the history of the industry electric current has supplanted steam power for exploiting lumber resources of a region. An electric transmission line of 32,150 feet was constructed, penetrating the densely wooded areas of the National forests, and rendering available for market 14,000,000 feet of timber.

Electrifying the woods was a "trail-blazing" feat of difficult attainment. A steam donkey or locomotive, minus the steam, was the nucleus for initial experiments. Without steam, the first obstacle encountered was the absence of a signal whistle. As a makeshift arrangement, an electric horn was attached, located 50 feet from the electrical equipment; but the din of machinery operation rendered indistinct the clarion call of the whistle in giving signals to the working crew.

Here is how the problem was solved: A 2½ by 3 air compressor was installed, hooked up to a 3-horsepower motor. The compressor is piped to a storage tank, 30 by 60 inches, and the pressure is constant at 100 pounds. Driving the air by the operation of the motor, about five minutes each hour, the pressure is sufficient to take care of the whistling.

Logging by electricity was begun with a 250 kva. transformer, subsequent developments proving the inadequateness of this capacity. Tests, however, have not offered definite recommendations on this point. The transformer, at donkey end of transmission line, is placed three or four hundred feet from the spar tree, obviating interference of yarding and loading.

The 13,000-volt transmission is terminated on two poles at 8 foot centers, at the transformer. A disconnect switch is mounted on these poles, making it feasible to cut off the current at this juncture. Current from the 550-volt side of the transformer is conveyed to the motor through a 3-conductor armored submarine cable placed along the ground between the transformers and yarder motor.

Difficulties of operating the motor slowly enough to be in unison with the requirements of logging and in regulation of drum controller in starting, stopping and controlling speed of the motor had to be surmounted. Acting upon the theory that it is essential to add re-

sistance in rotor circuit until the motor speed is lessened sufficiently, the electricians then rearranged the wiring of the drum controller for the accommodation of a wider range of control. Barrels of water were connected with each of the three phases of the rotor circuit until the speed required was ascertained by raising or lowering the barrel of water to the circuit.

Imagine the exasperation of the lumberman hauling around barrels of water as excess luggage to an equipment already cumbersome! But the tests of connecting the donkey engine with the water barrel is not a frequent performance. Basic information is available from a single experiment: Simply calculate the watts dissipated in each barrel and the carrying capacity necessary to be obtained in some other form of resistor. The Washington logging company added a resistance of 3 ohms in each of two phases and a resistance of 6 ohms in the remaining phase of the rotor circuit.

A cost accounting system has been kept to indicate the expenditures as well as the merits of the system of logging by electricity. For building and maintaining the transmission line, calculations have been based on 5 per cent depreciation for the copper and conductor, 20 per cent depreciation for cross arms and insulators, and 100 per cent for labor and incidentals. A half a day is required for four men to establish the transformer every time the yarder is moved to a new setting. The yarder has been in operation for 234 consecutive days without interruption for repairs.

Comparative costs of logging with electricity and steam, as evidenced by the records of this Western lumber company, produce the following fact: Electrically-driven yarder logs for 52 cents per thousand less—saving \$7,280 in 210 days on a yarder alone. Supplement the cost of maintaining motor and controller, and the total cost is only 11 cents per thousand feet of timber. It requires 2.8 kilowatt hours energy input to log 1,000 feet.

Aside from the possibilities of developing power sufficient to do logging in heavy timber, at a reasonable outlay of expenditures, the United States Forest Service considers the introduction of electrical equipment as an added precaution in minimizing the annual toll of \$40,000,000 exacted by forest fires. Logging equipment and camps are the sources of unnumbered forest conflagrations.

The electric yarder and duplex loader in operation form the subject of our present colored cover.

The Civil War Carved in Granite

By James Anderson

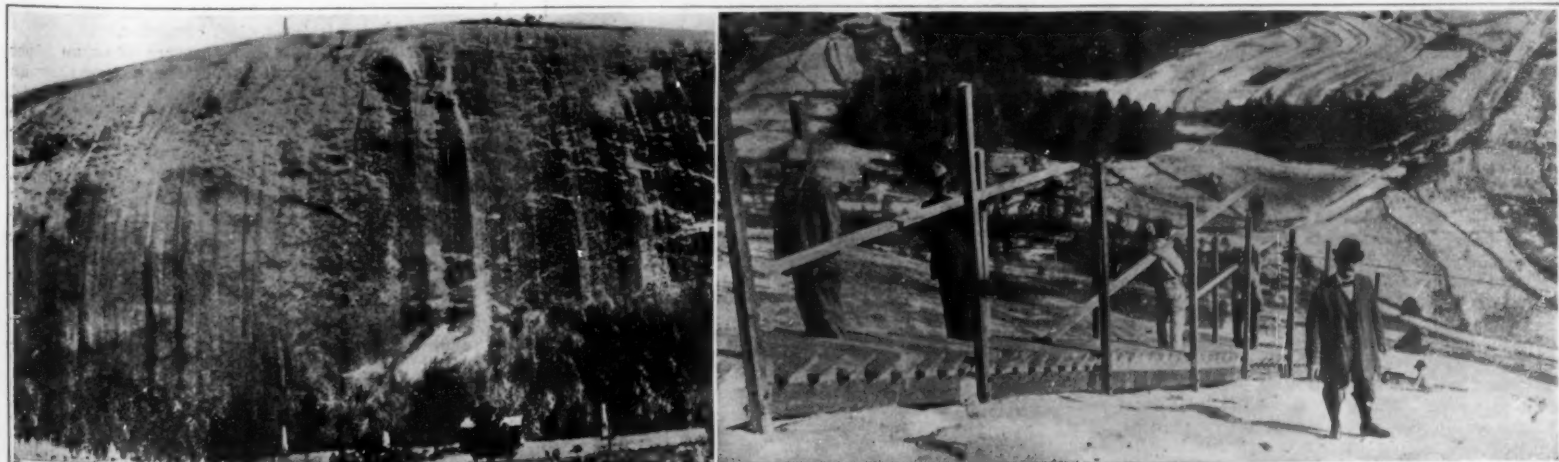
STONE MOUNTAIN, a solid granite monolith rising sheer out of the landscape about twelve miles east of Atlanta, Georgia, will begin this spring to assume the aspect of a granite memorial to the Civil War. "The Lost Cause," a gigantic sculptural representation of an army of one thousand Confederate leaders, is to be carved in the face of the mountain, which is fifteen hundred feet long and one thousand feet high. After eight years of planning, the engineering framework for this stupendous monument is being laid, so that in the spring work on the army may be started. Gutzon Borglum, the eminent American sculptor who originated the idea of this vast memorial, is to superintend its execution.

Plans had been completed in 1917 for beginning the work when America entered the World War. The mountain had been surveyed, and a road cut to the top. Even hoist cables and some machinery had been installed. Nothing further was done, however, until January of this year, when complete support was pledged for the renewal and completion of the undertaking after the unavoidable interruption.

The huge nature of the conception staggers the imagination. Big as the mountain is, it is absolutely without seam, crevice, or fissure. The monolith's southern, eastern and western exposures are oval in shape, so that the vast natural canvas is like a tea-cup cut in two. No other stone in the world, so far as known, affords so wonderful an opportunity for the sculptor. Mr. Gutzon Borglum says the quality is perfect, as the gray granite of the northern side, where the army will take shape, is protected from the sun and is not affected by the weather. There is never sufficient frost to react on the stone. The southern exposure is influenced slightly by the action of the sun, but the moisture of the dew creates a slight expansion, so that altogether conditions are ideal for a permanent memorial.

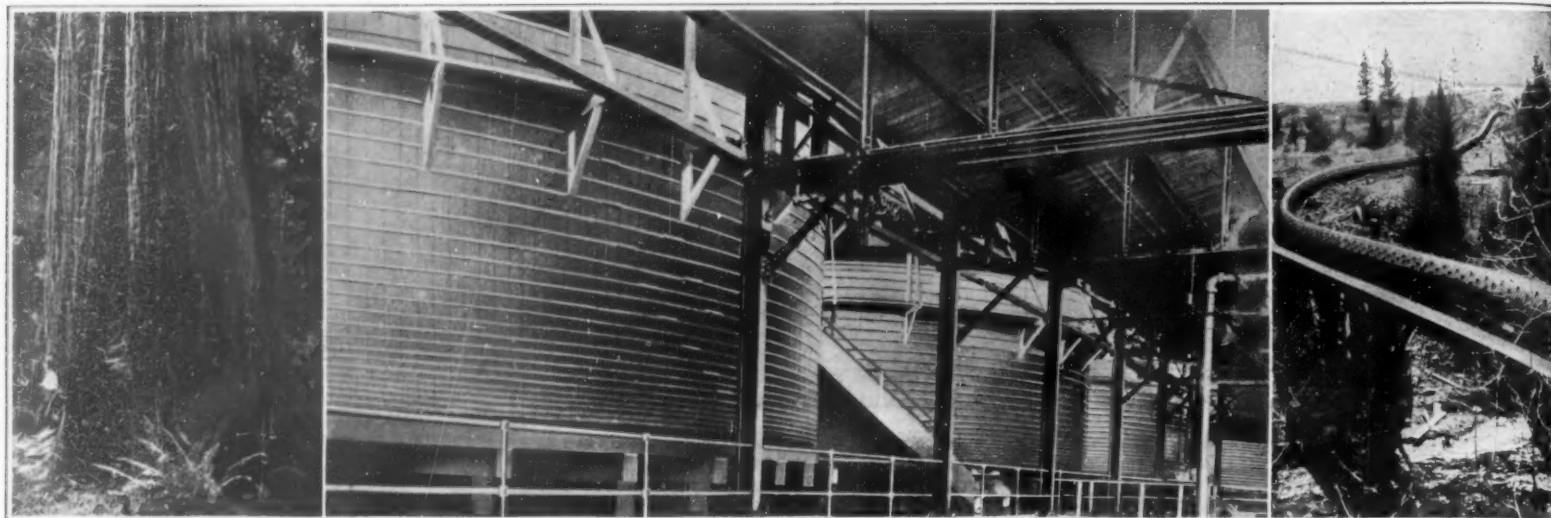
The sculptural aspects of the work presented a task which might have made an artist less experienced than Mr. Borglum shrink from beginning it. The plans have, however, been completed. The army is to be composed, as said, of one thousand complete figures. Each figure will represent some leader in the Army of the South, but more than that—each will be a portrait capable of

(Continued on page 297)



Left: The northern exposure of Stone Mountain, on which the Borglum sculptural representation of the "Lost Cause" will appear. Right: View of the countryside from the top of Stone Mountain

The natural canvas on which the Civil War is to be painted in granite



Left: Redwood tree, showing its size as compared to the man, who can be seen on sufficiently careful search of the picture. Center: Seventy-five large thickening tanks of redwood in a big copper refinery at Anaconda, Mont. Right: A wooden stave pipe line of redwood, installed by the United States Reclamation Service in Montana

The redwood tree, and some of the uses found for its wood

Some Special Uses of Redwood

The Pride of California's Forests and Some of the Roles That It Plays

By Arthur L. Dahl

THE California redwood has become famous throughout the world for the age and size of its trees, for outside of the *Sequoia gigantea*, or "Big Tree," the redwood is the oldest living tree, some of them being over 3,000 years old. The trees, in their majesty and grandeur, are well worth preserving in limited groves, to be used as national monuments or playgrounds for the people, but there are thousands of acres of virgin redwood forests in California that are available for the commercial needs of the people.

The very qualities that have enabled the redwoods to defy time and live on through the centuries, make the lumber from the fallen monarchs especially valuable for certain specific uses. While redwood is used for all kinds of construction and finishing purposes in the districts contiguous to where the lumber is manufactured, a larger market has been created for this species for use in the manufacture of tank and pipe staves, paving blocks, shingles, ties, and many other articles. The heartwood varies in color from a light cherry to a dark mahogany, and the wood is generally straight-grained and is comparatively light and soft. Redwood is more highly resistant to fire and the attacks of insects than any other species, and these qualities have caused a great many manufacturers to use the wood in the construction of silos, water tanks, roofs, fire walls, and other things where it is desired to guard against fire or the attacks of insects.

Redwood is peculiarly immune from either dry or wet rot, for cabins built of redwood in California more than 110 years ago are still in use at Fort Ross, and although these cabins are in exposed places in the fog belt, where for many months in the wet season they are exposed to heavy rains and the cold wet fogs that sweep in from the Pacific, they show not the slightest rot or decay. Redwood fence posts, dug up after 75 to 100 years of service, show no signs of decay. There are instances of giant redwood trees having been struck by lightning and broken down, and lying for centuries without having the wood affected in any way. One such case is of a tree trunk that lay on the ground for 900 years, and yet, when the area was logged over, this trunk was made into lumber.

It is a universal practice to use redwood door and window frames in California, and even though buildings are constructed of other kinds of wood, redwood is always used for that portion that comes in contact with the weather, as well as that part covered when the frame is set into the building and which is likely to be reached by moisture or rain seeping through the casing.

Redwood not only defies decay, but resists the destructive action of acids and alkalis, and it is commonly used in the manufacture of tanks containing chemicals. The big copper companies use redwood leaching tanks that contain corrosive acids for the refining of copper. At tanning works, redwood tanks that have been in constant use for 55 years are still

good for as many years more, and the California Wine Association has used the same redwood tanks for over 25 years and they are as good as new today.

Redwood is successfully used as insulating material, and one silo manufacturer states that two inches of redwood is equal to 3 inches of concrete in insulating power. In a large plant for the making of ice, redwood was used throughout, and although this plant has been in operation over 15 years nearly all of the redwood boxes encasing the brine piping are still in use. In

spite of the fact that the temperature of the inside of these insulation boxes is 6 degrees above zero, and the temperature in the engine room of the plant is 80 degrees, there is no shrink, warp, swell, twist or check in these boxes, nor is there any gathering of frost on the outside of the boxes, which would indicate free conductivity through the wood.

Redwood is largely used in the manufacture of coffins and burial boxes. The natural fineness of the grain works up well, and the surface can be stained to any desired effect. Its natural decay-resisting qualities enable coffins made of redwood to last longer underground, and the United States Government has found that redwood coffins are best suited for use in the tropics because it affords the highest type of protection to the body. It is very resistant to the termite or white-ant of the tropics.

Redwood enters largely into the manufacture of brooders and incubators used in the poultry industry. An incubator, because of the difference in temperature between the interior and exterior, requires a wood that holds a tight joint, is unaffected by differences in temperature, or alternating wet and dry atmospheric conditions.

For the manufacture of cigar boxes, candy boxes and other light containers, redwood is coming more and more into vogue. The wood is light, does not warp, makes tight joints and has a pleasing appearance. A number of candy shops on the Pacific Coast feature redwood box containers for their goods, and orders come from all parts of the country for the candy packed in the boxes which can be used permanently for other purposes. One shirt waist maker of the East uses large quantities of light redwood boxes which are utilized in making shipments to tropical countries.

Redwood is used in the manufacture of organ pipes because it does not vary in the slightest degree through change in temperature or atmospheric conditions, and its freedom from pitch and gum enables its use for the finer parts coming in contact with the felts and leather valves of an organ.

Because of its light weight and resistance to rot, California redwood was used for the clock hands on the tower of the Custom House at Boston. The minute hand is 16 feet long, and weighs 141 pounds, and the hour hand is 12 feet long and weighs 112 pounds.

Redwood is quite generally used for floor coverings and redwood blocks are excellent for street paving; and there are many examples of the satisfactory wearing qualities of the wood when used for these purposes.

The original machine shops of the Union Iron Works at San Francisco were floored with redwood blocks in 1893, and they are still giving good service. In fact, when the Bethlehem Shipbuilding Company built its new plant in Alameda, the flooring was all made of redwood blocks, and the United States Government used the same material in flooring the machine shops at



Two 30,000-gallon tanks of redwood on a single stand in California

(Continued on page 297)

Rails and Railroads

Some Facts and Figures of the Annual Traffic in New and Old Steel Rails

By Robert G. Skerrett

MUCH has been written about the mechanics and the metallurgy of steel rails such as we have on our various trunk lines. The public in a measure is conversant with what has been done toward producing heavier and better rails designed to support greater loads and to stand up under the hammer blows and the cold-rolling action of rushing wheels. But comparatively few of the shippers of freight and the traveling populace know what happens to the rails during their life history and what is done with them when they are no longer deemed fit for main-line service.

The story of the steel rail from the time it is first laid until it is totally transformed in its conversion to other uses is one of economics and conservation that is well worth the telling. It shows how keen and careful the best of our roads are to save their pennies and it reveals that the dealer in secondary metals has found many ways in which the steel may be worked up before it reaches a stage known to the trade as scrap.

We have today a total railway mileage of something like 350,000 miles of single track of all kinds on our trunk lines; and the wear and tear upon this transportation network requires annually, on an average, rail replacements totaling quite 1,500,000 tons. If, for the sake of comparison, we assume these rails to be of the 90-pound type, then our mills have to turn out each year for renewals alone enough rails to build a single-track railroad more than 10,600 miles long—three and one-third times the span across the continent. It follows that the rails removed furnish material which can be used for many purposes just as it stands, or the basic metal can be converted into numerous shapes for which there is an ever increasing market.

Indeed, our busy trunk lines would have to lay each twelvemonth a much larger tonnage of new rails but for the efforts made by them to keep every rail in the track as long as it is safe to do so. This is one of the savings effected by the alert guardians of the maintenance of way, and it marks the difference between the practices adopted by efficiently administered lines and those that are less watchful of the leaks that add to operating costs. Most of us imagine that a rail once laid remains in that fixed position until worn to a state where it must be scrapped, but such is not the case. The average life of the run of heavy steel rails is probably about 25 years; and this covers their successive applications to different traffic needs before they are condemned by the roads and sold to the dealers in waste materials. Now let us take up this sequence of usefulness in a necessarily brief way.

Broadly stated, a new rail is originally laid in the main-line tracks for high speed passenger service where it is subjected to the severest stresses; next, it may take its place in the tracks of a subsidiary road where it can meet the less exacting demands of lighter traffic, or it may go to the freight track where, again, it will be found equal to the more ponderous but slower-moving trains; then, having done its bit in either of these departments, it may be put in running sidings, yard tracks, or industrial spurs. But what is it that determines when a rail must be shifted from its first position of high estate, so to speak? And what is done to make it stay there as long as possible?

In a general way, most of us are aware that trains are guided along the tracks by the projecting flanges on the inner edge of the rims of the great driving wheels and the lesser car wheels, and we know that the rims transmit the load. Therefore the bearing surface and the inside portion of the rail heads get most of the wear. In practice, however, the two neighboring rails in any section of track are seldom subjected to the same destructive forces, and their heads are usually deformed and ground away in differing degrees and at dissimilar points. The railway man's problem of maintenance of way would be a comparatively simple one if nature permitted him to lay his tracks in a straight line and upon a level plane. Even the easiest of turns or swings in the course of the line introduce difficulties; and these are intensified when the terrain imposes many curves. For example, in the run of 150 miles between New York and Albany 65 per cent of the route is curved, and over this stretch of road are rushed some of the very fastest of our heavy passenger trains.

On a curve, the ties are sloped so that the outer rail is higher than the inside one. This is done to check the tendency of a train to go straight on instead of swinging in the desired direction. The movement of a train on a curve, therefore, throws a heavier share of the load on the low rail and subjects the high rail to a greater side pressure. As a consequence, the high rail is ground away on the inner side of the head while most of the wear on the low rail comes on its top. The change of shape of the high rail widens the gage or interval between the tracks, permits the wheels to shift laterally more than they should, and, because of this, the lower wheels move toward the inside of the low rail and deform it radically, if this action be not arrested. And here it is we come to the means taken by the men of the maintenance of way division to neutralize the wear and to keep the rails in service.

Just once so often the gage of the road and the state of the rails is measured by an apparatus called a rail-section machine, and this device traces the contours of the rail heads and reveals precisely how and to what extent they are being worn or altered. With this data, it is practicable to tilt or to so reset a rail that the wear will be lessened or shifted to another part of the head. Again, the trackmen, by moving the rails closer together, can restore the proper gage and minimize the lateral play of the wheels which is apt to be rapidly injurious if not kept within certain bounds. Further, a somewhat worn high rail may still be good enough to serve as a lower rail, and this transposition is a common practice.

A rail in a straight stretch may have its head worn down uniformly but be otherwise sound and, superficially, may appear fit to remain in the line. This loss

EACH twelvemonth our steam trunk lines replace their worn tracks with 1,500,000 tons of new rails. That is to say, they discard enough old rails to build a single-track road 10,600 miles long; and if those rails were rolled into a continuous rod an inch in diameter there would be enough of it to wind around the equator $9\frac{1}{2}$ times. As might be expected, this immense quantity of scrap metal is not allowed to go to waste, and before it ultimately reaches the furnace for remelting it is worked into manifold forms and put to scores of services. The purpose of the present article is to tell the life story of the rail from the time it is laid in the main-line tracks of a busy trunk line until it has ceased entirely to resemble the steel ribbon upon which the rushing express train threads its way.—THE EDITOR.

of metal, however, has robbed it of its "snap"—its capacity to react and to develop the desired springiness when subjected to the load of a passing train. Therefore, a rail of this sort that cannot meet the requirements of high-speed passenger traffic may answer very well for less exacting work. By watching and then nursing the rails into advantageous wearing positions, while maintaining the gage, the rails can be made to give a longer useful life. Not only that, but this care will render it practicable to employ a lighter and probably a cheaper rail.

On grades, as might be expected, even though the line is straight, the wear is heavy because of the abrasive action of the driving wheels when a train is climbing the slope. This grinding is intensified if the weight of the train or the condition of the track requires the use of sand. Again, the tracks in tunnels, either curved or straight, suffer deterioration at a fairly rapid rate owing to the presence of corrosive gases and dampness. It is interesting to note, however, that improvements in metallurgical practice are doing much to lengthen the useful life of rails.

In 1915 one of the most progressive of the eastern trunk lines substituted manganese rails for regular open-hearth rails, and laid these in an especially busy section where the high-grade, open-hearth rails had lasted only eighteen months, supporting the while 58,560,000 tons of traffic. The manganese rails up to date have withstood the wear and tear of 290,900,000 tons and will endure for a number of years to come. Any stretch of road carrying 50,000,000 tons in the course of a twelvemonth is exceptionally active; and this particular division has averaged for some time past quite 44,000,000 tons annually.

And now let us see what becomes of the 1,500,000 tons of rails that are scrapped every year. A goodly percentage of these second-hand rails are purchased by dealers in such materials and sold to industries that need spurs feeding to and from the main-line tracks. The unaltered rails are put to use by lumbermen in log-rolling outfits, and they serve admirably for the tramways of brick yards, sand pits, stone quarries, etc. Where large engineering undertakings are in hand, the rails are laid to support mechanical equipment, such as cranes, steam shovels, etc., and they provide the necessary lines of travel for spoils trains and for cars delivering structural materials. Light rails, as a rule, are well suited to work of this kind.

There is generally enough material left in the heads of the worn rails from our principal trunk lines to permit the rails to be rerolled and thus fashioned into sound ones of lesser weight. For example, an 80-pound rail can be reduced to a 30-pound or a 25-pound rail of greater length; and some experts claim that the rail is all the better for rerolling. The authorities, however, are not in accord upon this point. The light rails of rerolled stock are extensively employed in mines, on rice and sugar plantations, in strengthening the foundations of tall chimneys, in stiffening the support for pumps at the stations of pipe lines, and as buck-stays for vaults under side walks, etc. Indeed, old and even new rails constitute part of the defense of a good many safe deposit strong rooms.

Rails that have been so damaged in service that they cannot be rerolled into other rails or are quite unfit for transportation purposes in any direction, can be fashioned into a wide variety of marketable commodities. This is possible because of the excellent character of the basic stock. There are a number of rolling mills in this country which depend mainly upon old rails for their raw material; and it is astonishing how many things they are able to make from them. In some of these plants it is the practice to split the rails lengthwise into three parts, thus separating the head, the web, and the base, all of which are next cut into 4-foot lengths before heating and running them through the forming rolls. From the heads are produced round, square, and hexagonal bars; from the web is turned out flat steel for tires, etc., or U-shaped channels; and from the base or flange are obtained various small angle bars. From the web and base together it is feasible to roll tees and diamonds, U-bars, and the like, which are especially suited to numerous applications. One of

the biggest fields for bars made from old rail heads is that of reinforcing concrete in its well-nigh limitless adaptations, and the demand under normal conditions is in excess of the supply.

It may interest the average citizen to know something more about the way these manifold steel commodities fit into every-day life. The makers of agricultural equipment and machinery might be hard put to it for parts if it were not for the shapes, angles, and steel flats that have their origin in discarded rails. The frame, the bracing, and many other features of mowers, cultivators, harvesters, harrows, rakes, plows, etc., are formed of these materials, which insure both lightness and sturdiness. This department of industry absorbs yearly an immense quantity of the stock in question.

The next time you turn into your metal bed or throw yourself down for a moment's rest upon a couch, just remember that you may be reclining upon the by-product of a railroad track. In all likelihood the bed or couch frame, if not the frame for the springs, is composed of the angle bars already mentioned. The folding or collapsing beds so frequently tucked away in modern apartment houses are built up generously from steel of this character. In truth, much school and office furniture, many show cases, shop fixtures and kindred appointments have embodied in them these strong and light metal parts. It calls for no stretch of the imagination to grasp that the makers of automobiles, trucks, carriages and sleighs get certain of their fittings from the mills that rework second-hand rails.

As a matter of fact, if a person look about a bit, he'll find steel of the nature referred to doing service

(Continued on page 297)

Two Hundred Thousand Photographs per Minute

Eliminating the Shutter and Intricate Intermittent Movement to Speed Up Motion Pictures

By C. H. Claudy

COMPLETE visual analysis of complex and rapid motion has not, up to date, been possible except in rare instances. We see a horse gallop, a propeller revolve, a gun carriage recoil, but just *how* the horse's foot and leg move, just *how* the propeller bends under the stress of its revolution, just *what* happens to a gun carriage under the shock of recoil, we do not know.

Motion picture apparatus of the variety known as the "speed camera" solves but a part of the problem. Some cameras are made to take one hundred pictures per second—6,000 per minute. If such pictures be projected at the normal rate of 1,000 pictures per minute, the action on the screen takes place in six seconds, which took place in life in one second. The motion is thus shown six times slower. Most readers are familiar with those beautiful "floating" men, horses, dogs, cats, in pictures, which run, gallop, climb, very slowly. But six times slower than normal is not slow enough for projectiles, gun carriages, propellers and a dozen other rapidly moving objects of which motion analysis is urgently needed.

shutters, and use the lens to within a tiny fraction of its full value (about 99.5 per cent instead of the present day 33 $\frac{1}{3}$ to 50 per cent).

Continuous motion picture projectors have been invented before. But they were either prohibitively expensive, inefficient, delicate, used other than standard film, or were otherwise impractical and uncommercial. The Jenkins machine is far simpler than the normal intermittent motion machine, less expensive to make and maintain, has fewer moving parts, uses standard film and standard lens and requires just half as much current for lighting as the ordinary machine.

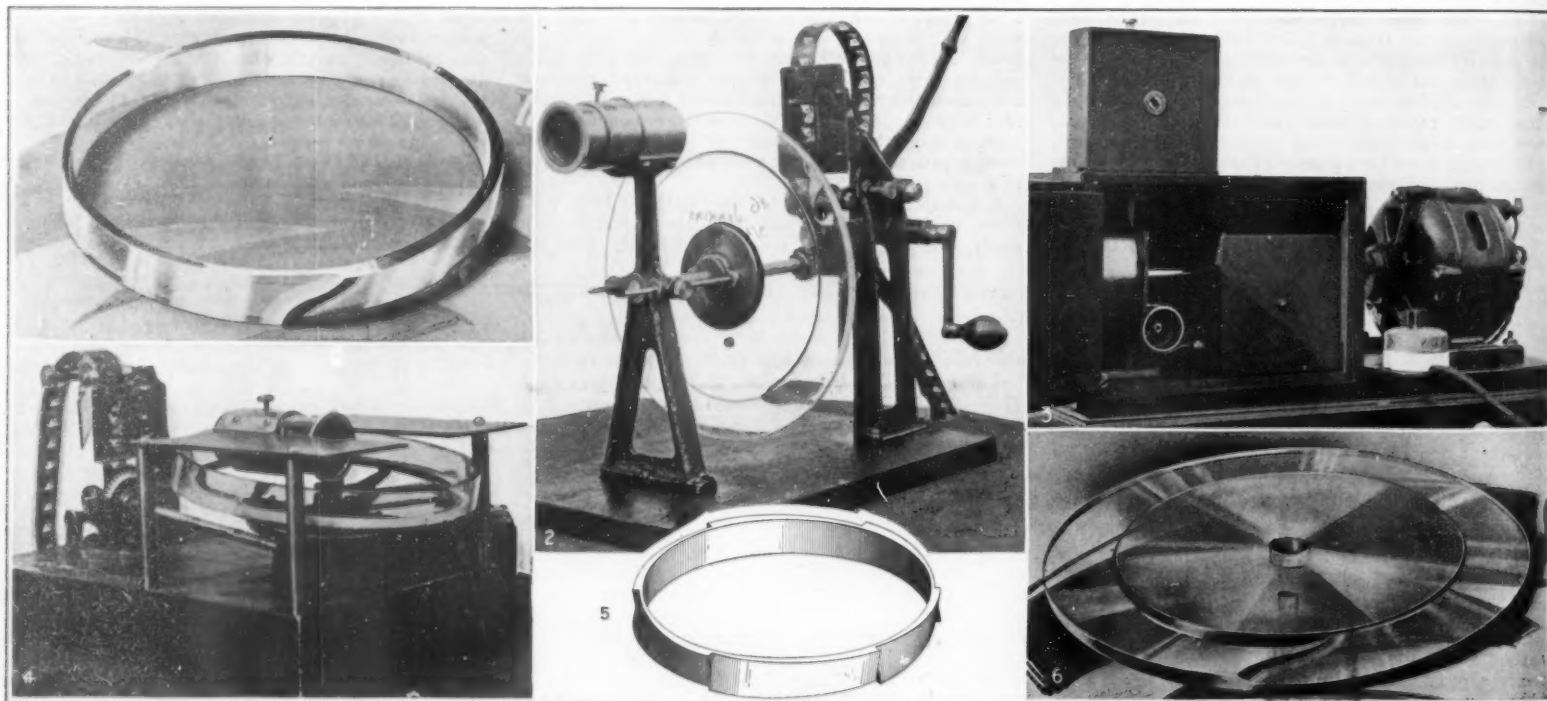
It is an extraordinary sight to watch a band of motion picture film running continuously from one reel to the other, with no stop, start, click, jerk or noise, and nothing but a smudge in the picture aperture, and then turn the eyes to the screen and see the usual moving picture. It is still more extraordinary when the simple means employed are understood. For the only additions to the ordinary projecting mechanism are revolving plates of glass, while the subtractions

no prism were interposed. But a moving picture mechanism which pushed thirty inches of glass prism from left to right and then jerked it back again to start another movement, would have an intermittent mechanism far more complicated and difficult than the present.

All of this Mr. Jenkins knew. What he did not know, however, was that he could bend the straight glass prism in a circle, join its two ends, and revolve it through the light cone.

The problem had to be solved from the very beginning. A prism which reversed itself through its length was bad enough, but one which was circular into the bargain required an entirely new grinding machine. Before Mr. Jenkins could grind the ring prism he had to invent the grinding machine which would make it. This he did, and with the intensely interested assistance of the authorities at the Bureau of Standards, the machine was put to work.

Grinding his reversed prism on the edge of a sheet of glass for convenience, he now has a projector equipped



1.—One of the Jenkins ring prisms of the simpler design, showing how the reversing prism effect is obtained. 2.—The simplest form of the new prismatic projector, consisting of a standard sprocket for moving the film continuously, a revolving plate prism, a lens, and a source of light which is not shown in this skeleton model. It will be noted that the elaborate framing device and intermittent movement mechanism of the usual motion picture projector are eliminated in this novel departure from standard practice. 3.—The high-speed Jenkins camera which, like the projector, makes use of a revolving prism instead of the usual revolving shutter and intermittent movement mechanism. This camera must be driven by electric motor in order to obtain a high and uniform speed. 4.—Another form of Jenkins prismatic projector reduced to its essentials. In this case the ring type of prism is employed. However, the ring prism is said to produce pictures less perfect than the plate form, although the optical principle is the same. It will be noted that the ring is inclined, so that the rays of light will only pass through the ring at one point. 5.—Diagram of the multiple prism ring used for the ultra-rapid camera. Six prisms are included in this ring. 6.—One of the Jenkins plate prisms.

High speed motion picture projectors and camera which make use of prisms instead of the usual shutter and intermittent movement mechanism

Hence, when C. Francis Jenkins, of Washington, D. C., originator of the intermittent motion which is the foundation-stone on which all motion picture apparatus is erected, announces a "continuous motion picture camera and projector," and declares he believes it entirely possible to make 200,000 pictures per minute which will slow up normal speed motion *two hundred times*, or make motion requiring one second in life extend over two hundred seconds of time in the picture of it, the scientific world is apt to take keen notice.

The Army and the Navy have already taken notice. Both arms of the Government have purchased these high speed cameras, after witnessing some examples of "slowed motion" made with them, and are keenly interested in the motion analysis which are to come from these instruments.

It must not be imagined that a continuous motion picture camera and projector is only of use in making motion analysis. Intermittent motions wear out. They tear the film. And they use twice as much light for the given result as the continuous motion, because they are provided with shutters, closed half the time, whereas the new projector (and the new camera) have no

from the machine are all the usual framing, shutter and film moving mechanism.

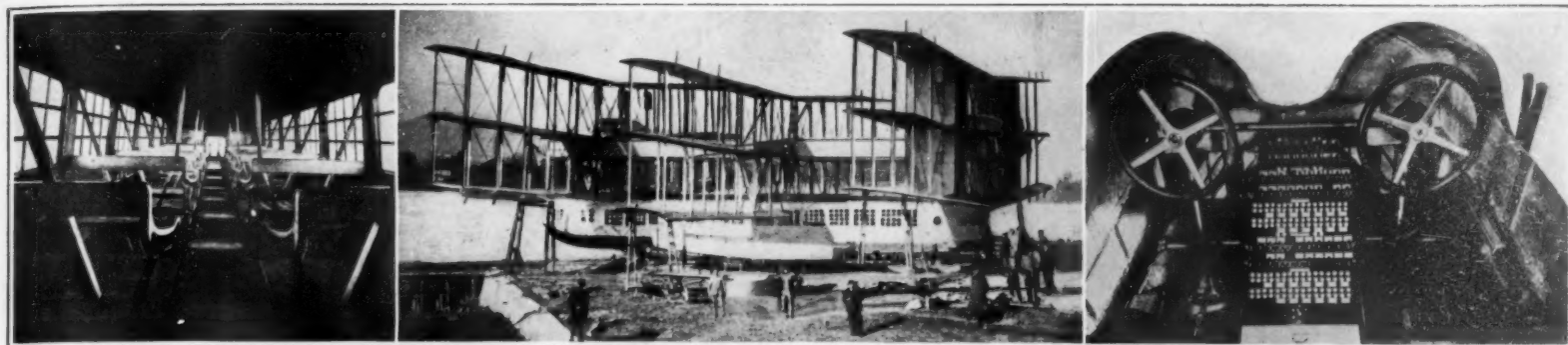
The theory of the Jenkins continuous motion picture camera and projector is simple. If it were possible to *hinge* the light rays after they pass through the lens in the camera so that they impinged on the film in one position and remained upon the film in that position as the film moved downward, the light rays would act upon the film in the same manner as unhinged rays would act upon a stationary film.

Such a hinge might be made of a long bar of glass, say thirteen inches long, which at one end was a prism with seven degree sides, its base above, its apex below, and which constantly changed its angles until at the center the "prism" was no longer a prism but a bar of glass with straight parallel sides, and then at the farther end was again a prism with its apex above, its base below. If such a reversing prism were slid lengthwise through the light coming from a lens, and the time it took in its travel was exactly the time required for one frame to pass through the picture aperture, that film would receive a complete picture without blur, exactly as if it stood stationary and

with two such ring prisms, operating with overlapping edges. Parenthetically, there would seem to be no mechanical or optical reason why both sides of this prism should not be ground on one pane of glass, reducing the moving parts. Mr. Jenkins has made and put into use ring prisms with six and eight completely reversing prisms in a single circumference which allows six and eight pictures per single revolution of the glass, thus requiring, for fifty thousand pictures per minute, but eight or nine thousand r.p.m. of the glass plate. Inasmuch as there is no reason why the glass circle may not have more prisms and be enclosed in a ring of steel, to take the centrifugal pull, there is no reason to suppose a limit of speed in making pictures which shall be caused by the strength of the materials employed.

Indeed, the limits have been set ahead away beyond that of mechanics. There is now no question, "Will the film tear?" as happens when much more than one hundred pictures per second are attempted with an intermittent motion. There is now no question, "Will the mechanism stand it?" The question is, "How

(Continued on page 297)



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Left: Looking forward in the passenger cabin of the Caproni seaplane. There are accommodations for 100 passengers. Center: General view of the giant seaplane on the ways. Note the rear set of planes which carries the vertical planes that act as rudders. Right: Controls of the giant machine, arranged in duplicate. The central panel carries the various push buttons and switches controlling the various parts and engines of the machine.

Three views of the giant Caproni seaplane recently completed in Italy

The Giant Caproni Seaplane

FOR over a year past there have been persistent rumors of a giant airplane being constructed by the Italian aircraft constructor, Caproni. This airplane was talked of in connection with a transatlantic flight; but later it was reported to have a carrying capacity of 10 passengers and to be intended for passenger-carrying purposes. At last the photographs and data regarding this Italian achievement have come out of Italy, although it is unfortunate that these should reach us only after the machine has been wrecked in the preliminary trials.

The Caproni machine proves to be a seaplane of radically—indeed, one might well say daring—design. It has three sets of triplanes arranged in tandem and mounted above a long boat body. There are eight motors of the Liberty type, aggregating 3,200 horsepower. The machine weighs 30,800 pounds empty, and can carry a useful load of 22,000 pounds. This useful load factor, when translated in terms of commercial utility, means carrying one hundred passengers with sufficient fuel supply for a flight of five to six hours. Beyond a doubt, this is the largest heavier-than-air machine so far constructed.

The boat-like body, which has accommodations for one hundred passengers, measures 66 feet long. The wings have a total carrying surface of 7,150 square feet. The arrangement of the three sets of triplanes is said to give this giant machine remarkable stability in the air, and permits of dispensing with the usual tail construction. Each wing carries an aileron, and it is the manipulation of these ailerons that controls the ascent or descent of the machine. The steering is controlled by eight rudders which are mounted between the wings of the rear triplane. Great stress is laid on the automatic stability of this machine, which is gained by the triplane and tandem arrangement, and the facility with which it can be piloted. And then it follows, too, that with the great weight and horsepower back of this machine it is not apt to be disturbed by the very winds that hamper the smaller airplanes. The Caproni giant, in flying trim, represents 25 tons.

The wings measure 132 feet in span. The motors are distributed as follows: Four in the front body, driving three tractor screws, and four in the rear body, driving three propeller screws. The speed is about 90 miles an hour when the engines are operating at full power.

Reducing the Electrode Costs of Electric Furnaces

IN operating electric furnaces for making steel, a source of a great deal of trouble and loss of heat is the action of the hot gases in the carbon electrodes themselves where they enter the roof. Here they are

usually eaten away with consequent loss of heat and electrodes.

A Philadelphia electrical engineer has developed what he terms an electrode economizer. It is stated that the loss from the amount of heat in the shape of flame that escapes from most furnace roofs is nearly 30 per cent. It was early realized by the inventor that if the flame could be prevented from blazing out at the top around the electrodes, one of the chief causes of



A three-ton electric steel furnace equipped with electrode economizers

losses would be overcome. The invention is patented and can be used on all types of electric furnaces.

The economizer depends for its action on the scientific principle that hot gases under pressure, if suddenly allowed to expand, quickly lose their high temperature. The gases generated in an electric furnace are only combustible at high temperature and in the presence of oxygen. All other cooling rings simply content themselves with cooling these burning gases. In the economizer the gases never ignite, the roof ports and the

electrodes are kept reasonably cool and the gases leaving the furnace are at too low a temperature to ignite.

The gases pass first of all between the electrode and the port-hole roof, and then through a small clearance into the cooling ring and into a relatively larger chamber which causes the expansion of the gases, thereby receiving a large amount of sensible heat. This heat is absorbed by the water in the cooling ring. From this chamber the gases are once more contracted through a small clearance and then passed to a very large chamber for a second and chief expansion. The design differs slightly with amorphous or graphite carbon electrodes, but the effect is that no flame is seen from the top of the furnace and the electrodes do not pencil off.

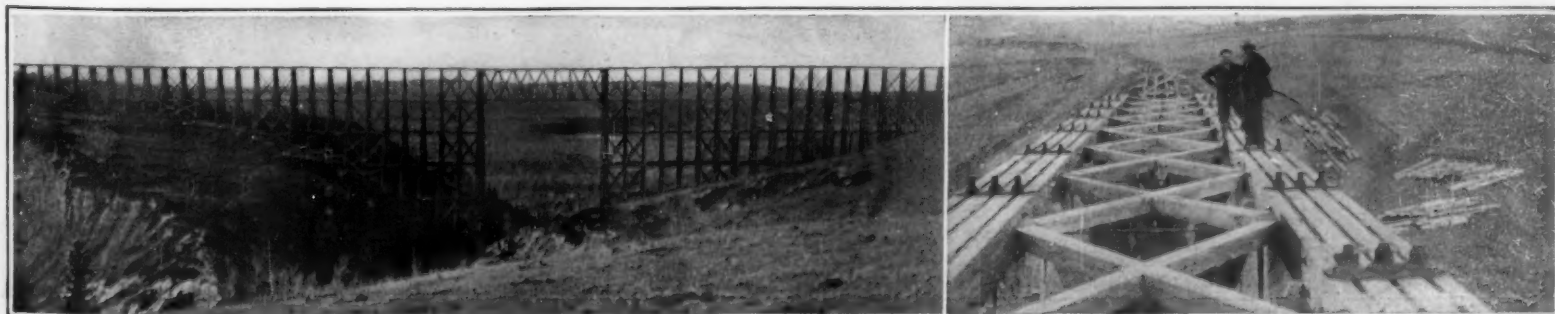
The illustration is of a 3-ton Greaves-Etchells furnace at Tacony, Pa., equipped with the economizer. It shows the actual size of the cooling ring, and it will be noticed that, although the electrodes are withdrawn and the furnace is pouring, there is no flame or reduction of diameter. Even when carbon is thrown on the slag, no flame appears. On a recently installed 4-electrode furnace, the monthly figures were 12½ pounds of graphite electrodes per ton. The average over six months was 13 pounds.

Recovering Fuel from Ashes by Magnetism

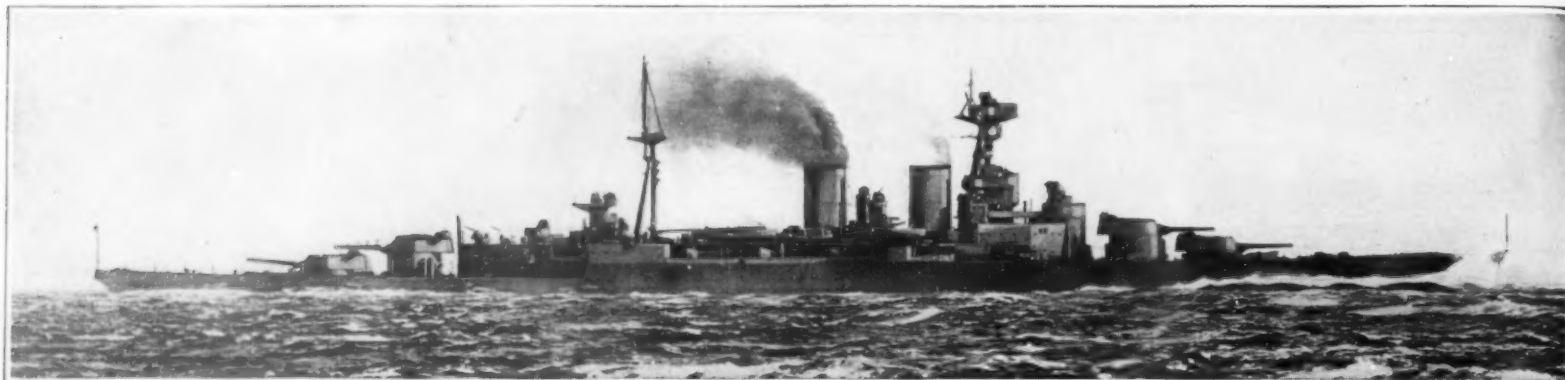
AFTER several years of experimentation the well-known German firm of Krupps has succeeded in perfecting a process through which large percentages of fuel can be recovered by means of magnetism from cinders. According to *La Revue Générale de l'Électricité* quoted in *La Nature* (Paris), for December 25, 1920, this process makes use of the magnetic property which resides in the cinders (scoria) because of the compounds of iron which they contain. It is stated that it is possible to recover in this manner in the form of coke no less than 25 per cent of the weight of the cinders. Since there is an annual consumption of about 100,000,000 tons of coal in Germany yielding 20,000,000 tons of cinders, the general application of the process would secure the recovery of the very considerable amount of 5,000,000 tons of fuel.

Salvaging the Timber in a Giant Trestle

AT Pincher Creek, in the Canadian province of Alberta, three of the world's largest wooden bridges or trestles are being torn down for the timber which they contain. The one shown in the two accompanying illustrations is the largest of the three, being over one-half mile in length, and 235 feet high. It is said to contain over 1,200,000 feet of timber, which is being reclaimed for shipment to France for reconstruction purposes. The trestles formed part of an abandoned coal mine railroad.



Two views of a wooden trestle, over one-half mile long and 235 feet high, which is being dismantled for its timber



Length, 860 feet. Beam over bulges, 104 feet. Draft, 28½ feet. Displacement, 41,200 tons. Speed, 31 knots. Armor: Belt, 12 inches; barrette, 12 inches; turrets, 15 inches; decks, 1, 2 and 3 inches. Guns, eight 15-inch, twelve 5.5-inch. Torpedo tubes, 6

The latest British battle-cruiser, "Hood"

The British Fleet of Today

A Detailed Account of the Drastic Reductions in the Strength of the British Navy

By Hector C. Bywater

JUDGING from recent discussions both in Congress and the American press there appears to be some misapprehension as to the present strength of the British Navy. It will therefore be opportune to give a brief review of British naval policy during the past two years. The armistice intervened at a moment when the national capacity for producing naval tonnage was at its zenith. Practically every yard in the United Kingdom was at work on Admiralty contracts, including many establishments which had not previously built fighting ships. Twenty-four hours after the armistice had been signed orders were issued for the canceling of every naval contract which had not reached a certain degree of completion. At that date the only capital ships under construction were four battle-cruisers, viz.: "Hood," "Anson," "Howe," and "Rodney." As the first-named had been launched it was decided to complete her, but the remaining three were scrapped, and with them went a considerable number of light cruisers, scores of destroyers and submarines, and hundreds of patrol vessels, auxiliaries, and minor craft. Those that survived this drastic "comb-out" were vessels on which so much money had already been spent that it would have been false economy to dismantle them; but they are completing at such a leisurely rate that one of them, the cruiser "Edinburgh," which was laid down at Portsmouth as long ago as 1917, has not yet been launched. On March 1, 1921, the British naval construction program stood as follows: Battleships or battle-cruisers building or projected, none; light cruisers building or completing, 8; destroyers, 7; submarines, 4. The only

other vessel in hand is the aircraft carrier "Hermes." The fact that no capital ships of any description are now building is unprecedented in British naval history for the past two centuries; as a matter of fact, the historians say that to find a parallel to the present stagnation in British dockyards it would be necessary

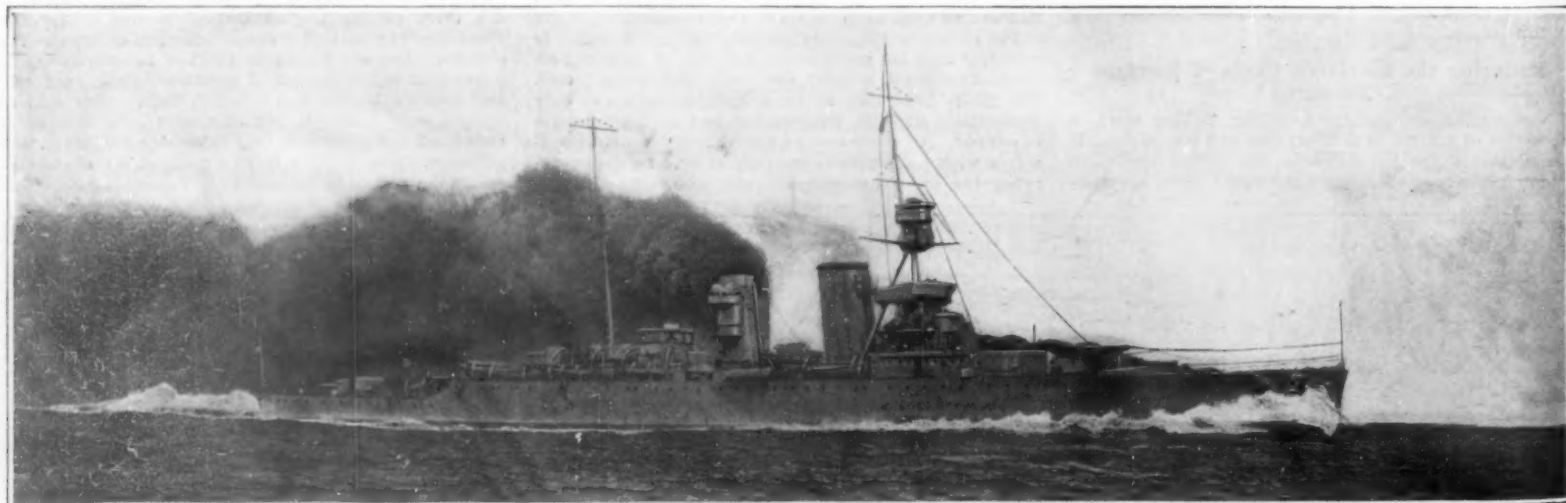
to go back at least as far as the seventeenth century. Simultaneously with the cancellation of uncompleted ships, steps were taken to cut down the naval establishment by selling off all redundant material and reducing the commissioned fleets to a minimum, a dual process which has been going on steadily since November, 1918, and still continues. Vessels scrapped to date include 4 dreadnaught battleships, 2 battle-cruisers, 20 light cruisers, 200 destroyers, 30 submarines, to say nothing of the whole fleet of predreadnaught battleships and armored cruisers which have been stricken off the navy list and sold to the shipbreakers. In the opinion of many authorities this process has been carried too far. Light cruisers completed as recently as 1916 have been disposed of, together with destroyers and submarines less than three years old. It is not denied that a large majority of the doomed ships would have been capable of many more years of active service; but the economists were inexorable, and scores of really fine vessels have been sold as junk.

By April, 1919, the Admiralty had worked out a scheme of post-war fleet distribution which, in their judgment, was the minimum necessary to safeguard British interests at home and abroad and to render possible the carrying on of progressive tactical and sea training. Their proposals embraced the maintenance, in full commission, of an Atlantic Fleet, consisting of ten battleships ("Queen Elizabeth" and "Royal Sovereign" classes), four battle-cruisers, one light cruiser squadron, three destroyer flotillas, and four submarine flotillas, together with a Home Fleet, manned on the nucleus crew system, of six battleships, one light cruiser squadron, and two destroyer flotillas. In addition a "Flying Squadron" of aircraft carriers was to be attached to the Atlantic Fleet. For the Mediterranean a fleet of six battleships, six light cruisers, and a destroyer and submarine flotilla was proposed; while to the other for-

MR. BYWATER, who is one of the leading naval writers of Great Britain, wrote this article at our request, with the object of placing before American readers an accurate and detailed account of the great reduction which has been made in the British Fleet since the Armistice, and a statement of the actual strength of the existing fleet which is now in commission and in reserve. Since this article was prepared, the First Lord of the British Admiralty has announced that a further reduction has been made in the strength both of the whole fleet and of that part of it which is in full commission.

The number of battleships and battle-cruisers in full commission has been reduced from twenty to sixteen as compared with a total of thirty-eight in 1914. One of the destroyer flotillas of the Atlantic fleet has been placed in reserve; the North American and South African squadrons have been reduced by one light cruiser each; and the South American squadron has been withdrawn. Also, eight battleships armed with 12-inch guns, which were held in reserve, have been transferred to the list for sale.—THE EDITOR.

(Continued on page 299)



Length, 606 feet. Beam, 65 feet. Draft, 17½ feet. Displacement, 9750 tons. Speed, 31 knots. Armor, 3 to 1½ inches. Guns, seven 7.5-inch, eight 3-inch. Torpedo tubes, 6

The latest light cruiser, "Raleigh"

Bending Ship Plates

SOME of the machinery necessary to construct the large steel ships of today is massive and striking. Its achievements are also equally interesting. The illustration is that of a large ship plate bending roll, used by shipbuilders to bring to the proper size and shape some of the heavy sections of steel plate which go to make up the hull or some important part of a modern transatlantic liner or merchant vessel. This machine is used to scarf simultaneously both corners of a very long and unusually thick steel plate. It will thus handle plate 7 feet wide and an inch thick and easily fastens it to the end desired. It is manufactured by a large Delaware company.

Potability of Salt Water

REMARKABLE instances of the extent to which men and animals can become habituated to the drinking of salt water were given to the Australian Association for the Advancement of Science. A man living in South Australia asked for a water analysis and it was found that it contained 1 1/7 ounces of solids, mainly salt, to the gallon. This is well beyond the limit set by the desert laboratory of U. S. A. as the maximum for water capable of sustaining life even for a limited period. Yet this man had been drinking this water mostly in the form of tea, for three months.

A Direct Motor-Driven Tenoner Saw

A SAW tenoner which may be operated without a countershaft or belts and which may be set and operated without regard to shafting is a new product of a Massachusetts manufacturer.

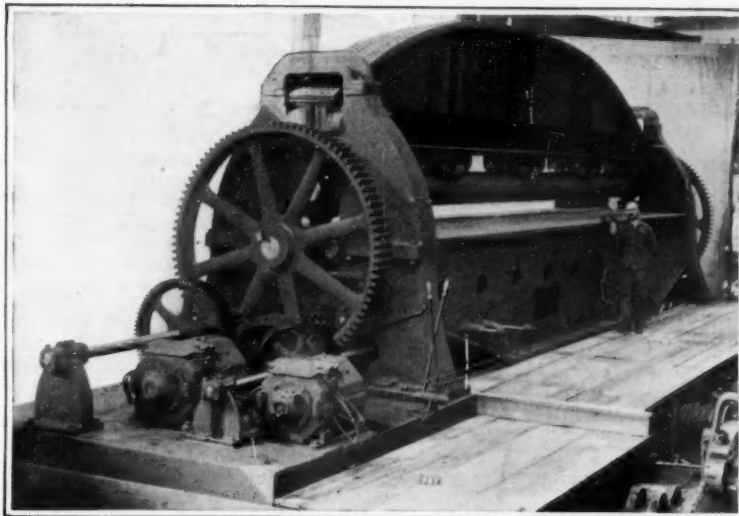
In place of the pulleys an alternating current motor with a speed of 3,450 r.p.m. is mounted on each saw arbor. The housing of each motor is made a part of the yoke which carries the saw arbor and bearings. The carriage is equipped with ball bearing wheels that operate on a double track supported on a knee that is raised and lowered by a handwheel.

The table may be tilted either above or below the center and locked at any angle up to 22 degrees. The top and bottom saw arbors are mounted in yokes raised and lowered by elevating screws operated by handwheels. The yoke that carries the top saw arbor has a horizontal adjustment to line up the top saw with the bottom saw or to cut an offset tenon if desired. The vertical arbor carrying the splitting saws is mounted on a yoke which has a horizontal adjustment to move the saws to and from the work.

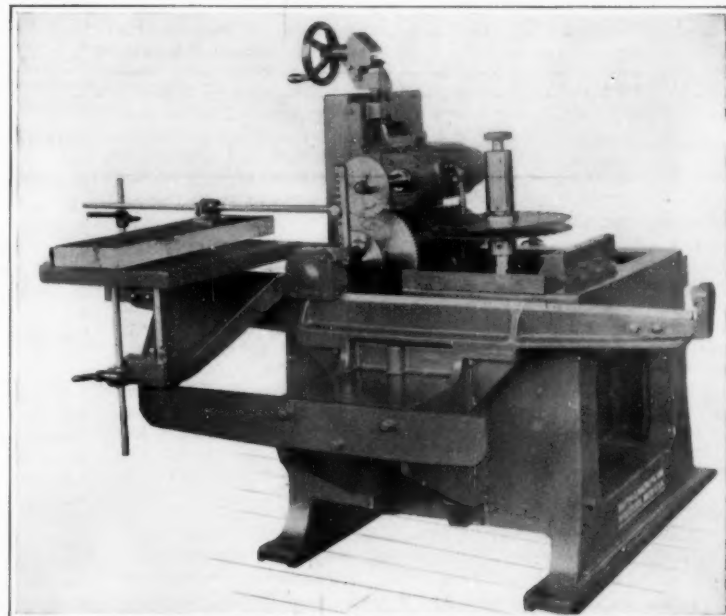
Tenons from 3/16 inch to 3 inches thick and up to 6 1/2 inches in length may be cut at one operation. Saw cut tenons have a better surface for holding glue and tighter joints are a result. Starting switches mounted on the machine start and stop, independently, the motors. By eliminating the belting and countershafts a great saving in floor space is effected.

A Press of Imposing Proportions

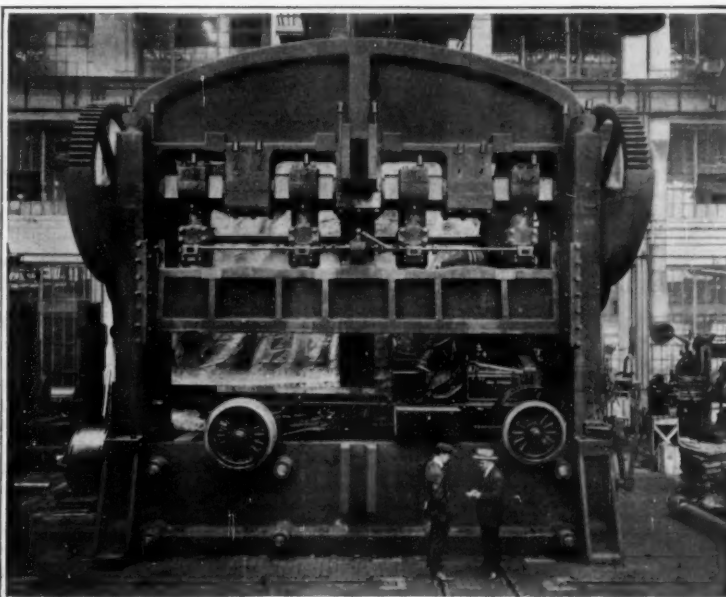
SOME idea of the machine processes employed in the production of the modern automobile and motor truck may be got from the accompanying photograph, which shows an enormous press used in the blanking-out and perforating of the side rails for the largest size of motor truck frames. It can, however, be used for other purposes, and even for forming operations. This press is twin-driven and triple-gear, the gears being of steel. The bed is 252 x 48 inches; the slide face 242 x 40 inches; the total height is 25 feet 9 inches. The normal speed of the press is five strokes per minute. The truck chassis shown in the photograph was posed for the purpose of giving some idea of the size of the press, and seems to do this about as effectively as it could be done.



Machine for bending heavy plates for the hulls of big ships. It is used to scarf simultaneously both corners of a very long and unusually thick steel plate. Note relative size of man



The shaftless motor-driven tenoning saw outfit, which cuts tenons from 3/16-inch to 3 inches thick and up to 6 1/2 inches in length at one operation



Big press used in motor-truck manufacture, and the way it sizes up against its product. The normal working speed of this press is five strokes per minute for forming and perforating heavy frames

The Current Scientific American Monthly

AMONG the contestants of the Einstein prize was one of our leading astronomers, Dr. William H. Pickering of the Harvard College Observatory in Jamaica. Dr. Pickering contributed two essays, both of which impressed the judges as being scientific critiques of the relativity hypothesis rather than popular explanations within the intent of the contest. It goes without saying, however, that they are both very interesting and authoritative and are written in a clear and simple style. In one of these essays Dr. Pickering writes as a physicist, and in the other as an astronomer. In both he conveys the impression that while he recognizes the importance of the Einstein theories and stands ready to give them every fair hearing, he regards them as still unproved in full. The two essays have been welded into a single article, which is published in the April issue of the SCIENTIFIC AMERICAN MONTHLY.

A very useful article for those who are interested in meteorology, as well as for the general amateur photographer, is one by Arthur J. Weed, on Cloud Photography. He gives full details of the construction of the necessary apparatus and their use, so that anyone who wishes to may engage in the fascinating work of photographing the clouds.

An important article on the field of biology bears the title "Why Roots Grow Downward." The modern statolith theory of geotropism is fully explained. The sensitiveness of the extreme point of the root to the stimulus gravity is due to the position of starch grains in the cells, which, under the influence of gravity, sink to the lower wall of the cell and induce growth in that direction.

During the war the shortage of explosives made it necessary for the Germans to search for other means to be employed in mining operations. They reverted to a process that was tried out during the driving of the famous Simplon Tunnel. In the excavation of this tunnel, cartridges of crude petroleum, soot and Kieselguhr were saturated with liquid oxygen and when ignited burned with explosive force. These cartridges were greatly improved upon during the war, and they have recently been under investigation by the U. S. Bureau of Mines. They are described in the current issue of the SCIENTIFIC AMERICAN MONTHLY.

A very important article entitled "Industrial Applications of Hydrogen" was specially prepared for the SCIENTIFIC AMERICAN MONTHLY by Harry L. Barnitz, Ph.D. This is one of the most complete surveys of the use of hydrogen in various industries and is fully illustrated with diagrams showing the manner of application of this most important gas.

In the March issue of the SCIENTIFIC AMERICAN MONTHLY we published an article on Leonardo da Vinci as an inventor. In the present issue there appears another article by the same author on Leonardo as an aviation engineer. This is illustrated with diagrams from Leonardo's own manuscripts, showing his remarkable ingenuity and the anticipation of many modern aeronautic inventions.

The British Government is fitting out twelve of its Handley-Page bombing machines with a new type of stabilizer invented by M. Georges Aveline. This stabilizer is part electric, part pneumatic and part aerodynamic. It operates on the principle of a pendulum, a body of mercury in a circular channel serving as the pendulum, and ingenious means are provided for correcting the stabilizer against the action of centrifugal force. The construction has been very cleverly worked out.

Prof. E. W. Scripture has made an interesting study of the nature of vowel (Continued on page 300)

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Chemicals in Japan

THE following is abstracted from the *British Board of Trade Journal* relative to Japan's imports and exports of chemicals:

Chemicals, the volume of imports of which has greatly increased in the past few years, are salicylic acid, caustic soda, cyanide of soda, soda ash, logwood extract, and aniline dyes.

Chemicals which have been in over supply during 1919 are carbolic acid, soda ash, glue, caustic soda, and rosia.

Owing to the difficulty of obtaining supplies from Europe, most of the above have been imported from the United States, while the following have been exclusively imported from there: bichromate of potash, acetate of calcium, milk sugar, and aniline salt.

The articles that have been imported more freely from Great Britain than from the United States are carbonate of ammonia, tartaric acid, white zinc, cyanide of soda, chloride of ammonia, gelatine, borate of soda, and citric acid.

Peroxide of soda and cyanide of potassium have been exclusively imported from Great Britain.

The following articles have been converted into export lines during the war: naphthalene, acetic acid, calcium, zinc dust, and copper sulphate, as have also several potash compounds, such as chlorate of potash and chloride of potassium.

Metal Conservation

IN considering the balance sheet aspect of scientific and industrial research we would do well to recall to what extent our personal safety and comfort depend upon the alloy steels, the non-ferrous alloys and their heat treatment. We not only have discontinued the practice of increasing the weight of vital parts to give them sufficient strength, but in some cases the size of such members has been decreased because heat treatment brings about changes which are responsible for a great increase in strength. Heat treatment, until comparatively recently, was not carried with the requisite temperature control to guarantee uniform, dependable results. The development of more sensitive pyrometers has made this control relatively simple, while at the same time new types of furnaces and pots greatly facilitate correct hardening. Preheaters are now employed to conserve fuel by utilizing waste heat and to save time in the heat treating apparatus.

Fish Scaling

FISH scaling is a defect in the enamel on sheet metal ware, which is responsible for large losses in manufacture. The Bureau of Standards has been investigating causes and prevention of fish scaling, and a part of the research has to do with the effect of the shape of the metal vessel on the phenomenon noted. Miniature basins are used for the test, and it has been found that certain portions of them consistently show fish scale. This is particularly true of the convex parts of the specimens. Also flat plates show fish scale more than do basins, which are free to expand and contract. The thermal expansion of metals used in this work and of rods made from various enamels is being determined. From the work done so far it seems that the enamels show a critical contraction at about 450° to 500° C.

Preservatives for Fermentable Beverage Samples

THE laboratories of the Ohio State Department of Health report the outcome of tests made by them with various preservatives for fermentable beverage samples intended for analysis. The article appears in the *Journal of Industrial and Engineering Chemistry* for July, and the general conclusions are that sodium benzoate, present to the extent of .2 per cent, is unreliable as a preservative, that sodium bisulphite and boric acid, 2 per cent are of no value whatever, but that mercuric chloride and salicylic acid .2 per cent are satisfactory preservatives. Because of the poisonous character and the expense of mercuric chloride, salicylic acid of .2 per cent strength is recommended as the preservative to be used when fermentable samples are to be tested for alcoholic content and when the immediate delivery of such samples to the laboratory is not possible.

Experiments were carried on with various types of near beers, some with and some without yeast, a part of the material being bottled and other samples purchased from bulk. Some of the near beers would not ordinarily ferment even when open, while others did ferment rapidly unless a preservative were added.

Tensile Properties of Boiler Plate

AN investigation upon the tensile properties of boiler plate at elevated temperatures has been in progress at the Bureau of Standards, which has made the following partial report:

A quantity of boiler plate has been rolled at a blue heat (300° C.) preparatory to determining the properties at elevated temperatures and also the effect of blue work on the tensile properties at normal temperatures. The effect of low temperature annealing on plates worked below the thermal critical range will next be determined. Special apparatus has also been constructed for the determination of the effect of rate of loading on the elastic limit at elevated temperatures. This necessitates the use of a motion picture camera for obtaining records of constantly moving dials and constantly increasing loads. Trial runs have been made and several desired modifications have already been installed. When finished, this investigation will yield more complete data than are now available concerning the effects of various thermal and mechanical treatments, below the thermal critical ranges, on the tensile properties of low carbon steel at temperatures up to about 470° C.

The Natural and Synthetic Compared

THE Committee on Therapeutic Research of the Council on Pharmacy and Chemistry of the American Medical Association conducted a study with a view to determining whether the so-called natural salicylic acid and salicylates have the superiority claimed for them as compared with synthetic products. The so-called natural products are derived from the oils of wintergreen or birch, whereas the synthetic materials are those provided by the organic research laboratory. The committee has concluded that, notwithstanding statements to be found in the older literature, no difference can be shown in the toxic dose for animals between sodium salicylate, natural or synthetic. The evidence for the difference claimed is not to be found in a clear and conclusive form in the medical literature, and synthetic salicylate has not been found to contain significant chemical impurities.

Consequently no difference can be detected either in the therapeutic or toxic effects between the natural and the synthetic products, if the tests are made under the conditions which eliminate the personal factor.

There are a number of salicylates now familiar to nearly everyone. Acetyl salicylic acid is more familiarly known as aspirin, a term that at one time was considered the exclusive property of one manufacturer, but which has now become a word common to the language and generally applied to the compound. Sodium salicylate is not irritating and is more rapidly absorbed than salicylic acid. Ammonium salicylate is popular. It is said to be tolerated by the stomach better than sodium salicylate. Lithium salicylate is largely used in rheumatic conditions, as it combines the effects of both lithium and salicylic acid. Another salt of salicylic acid is magnesium salicylate, and strontium salicylate is also familiar to the physician. Methyl salicylate is the artificial oil of wintergreen.

Temperature Control

A SERIES of popularly written advertisements based upon scientific facts and history remind us of the increasing extent to which we are dependent upon the control of temperature. The control of temperature finds its way into nearly every industry, and it affects our health and life because upon it is based pasteurization, sterilization and other processes which must be controlled to a degree. Even in the preparation of our food the control of temperature is playing an important part, and cook books, which in many respects are delightfully vague, are beginning to introduce standards of temperature for boiling and baking. This is especially true where work is on a large scale, and is one of the factors upon which the success of the large can-

ner, for example, depends to a great degree. No house wife is considered a failure because one jar in a dozen "works," but if one jar in a dozen, which is purchased, is found to have fermented there is trouble at once.

It is due largely to the control of temperature that we have been able to produce a wonderful range of synthetic colors, and in the dye factory temperature recording and controlling instruments are in evidence everywhere. The earliest experiments in refrigeration have been attributed to the Romans, who placed a bottle of wine in another vessel containing water, into which saltwater was added slowly while the bottle was rotated. In India the temperature is sometimes reduced by the rapid evaporation of water scattered over twigs or other mediums to give a large surface, and evaporation does the rest. But in modern refrigerating plants it is the thermometer that measures the degree of cold, so that it may be kept uniform without the waste of energy. In the rubber industry, in the metal industry, in the manufacture of glass, etc., etc., it is temperature control that does so much for us, and throughout our chemical work temperature is one of the dominant factors. It is easy to understand why scientists generally are very particular about their thermometers.

Sixth National Exposition of the Chemical Industries

THE announcement of the Sixth National Exposition of the Chemical Industries to be held the week of September 20-25 inclusive at the Grand Central Palace, New York, reminds us how rapidly the chemical industry in America has developed since the first exposition in 1915 when eighty-three manufacturers took part in an exhibit designed to show America what progress had been made by the chemical industries here. The number of exhibitors has increased year by year, three hundred and fifteen participating in the exposition held last year at Chicago. At the present time three hundred and fifty-eight exhibitors have taken space requiring four floors of the Grand Central Palace to be utilized for the purpose. The increase has not been confined to a number of exhibitors, for the public at large has shown a growing interest. There were sixty-three thousand in attendance during the first exhibit and one hundred and eleven thousand last year. There will be three special sections this year, the first being the Electrical Furnace Section, the second, the Fuel Economy Section, designed to show to advantage the various apparatus which assist in economic utilization of fuel, and third, the Materials Handling Section, which will show machinery of all kinds for conveying, transporting and otherwise handling materials.

Chemists and scientists in general are anxious to have the public fully utilize such opportunities as the exhibit affords to grasp the significance of the chemical industry in the United States. When such an understanding has been reached chemists may look for the type of legislation to be enacted which will encourage the industry.

American Potash Industry

NOTWITHSTANDING the fact that the fertilizer mixing season of the spring has closed, the American potash plants are running full time on contracts which in many cases will insure continuous operation to the close of the year. This is an encouraging situation and is due principally to the situation abroad. German sulfate of potassium sold at \$4 a unit all last winter and spring, and the German companies were able to pay 20 per cent dividends as the result of their 1919 export business to America. The French producers have also obtained as high a price as possible from the American importers, and it is apparent that unless there is some domestic competition America will be permitted to pay a price which may equal the \$7 a unit, which the American farmers were required to pay during the war. However, the present favorable condition of the industry does not mean that it has finally come to a sound permanent basis. The Europeans could, of course, swamp the American market if they were back to normal producing conditions, and it becomes an economic question to what extent we can afford to pay American producers to establish an industry that will protect the farming and other industries from excessive prices in Europe.

The One-Man Airplane for Everybody's Pocketbook

THE de Pischof avionette, recently flown in France with good results, represents the latest attempt to produce a small airplane of inexpensive construction and low operating costs. This diminutive airplane, which is shown in the accompanying illustration, is built entirely of metal and has a factor of safety of 9, with a total weight of 230 pounds. This reduced weight, with the high coefficient of safety, has not been obtained merely by boiling down an ordinary airplane, so to speak. Instead, the designer has reduced the number of working parts to a minimum while at the same time making each component perform as many objects as possible.

In a light machine the ordinary undercarriage is unnecessary. Experience has proved that the ordinary pneumatic tires absorb practically all shocks. So in the present de Pischof avionette this fact has permitted the use, as an axle, of the central section of the front spar of the lower plane, which provides the point of attachment for the lower planes, and for the bracing of the wing cellule, and also acts as the axis for the rudder pedals.

The engine is a two-cylinder horizontally opposed air-cooled 18-horsepower Clerget-Blin type, driving the tractor screw. The avionette has made 62 miles per hour in test flights, with a gasoline consumption of 11.2 gallons. It has climbed 3,700 feet in 52 minutes. In spite of its reduced dimensions and lightness, the machine is claimed to be extremely stable and quite controllable.

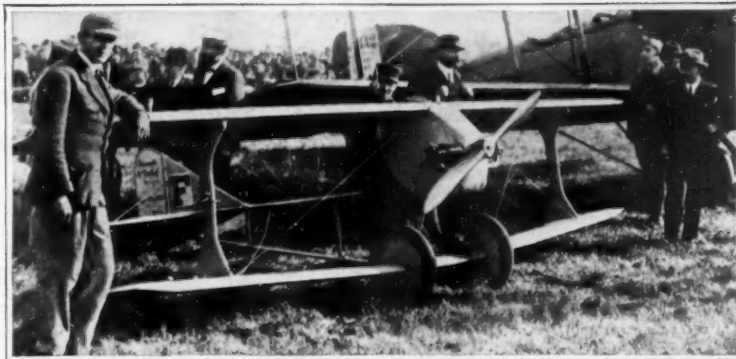
Reconstruction in Invaded Regions of France

THE Ministry of the Liberated Regions of France furnishes the following information relative to the resumption of operations by industrial establishments located in the liberated regions, employing over 20 persons: Up to August 1, 1920, 4,096 industrial establishments were noted in the census taken by the Government. Of this number 3,106, or 75.8 per cent, announced that they had resumed operations in whole or in part. In the Department of Meurthe and Moselle 82.2 per cent of the establishments had resumed operations, in the Ardennes 81.8 per cent were operating, and in the Department of the North the proportion attained 80 per cent. The city of Lille and the outlying districts show a remarkable increase in activity during the past year, 86.2 per cent of the industrial establishments having resumed business. It should be pointed out that a large proportion of these establishments are operating with only a small part of their normal equipment of men and machinery.

The 3,106 establishments included in the census employed 757,388 workers in 1914. On August 1, 1920, they employed 325,490 workers, or 42.9 per cent, of the normal number of employees. It is interesting to note that in July, 1919, the proportion of workers was only 9.7 per cent. In the textile, metal-working, and pottery industries almost one-half of the normal number of workers have returned by this writing, despite business depression.

Radium's Discoverer and Her Gift from American Women

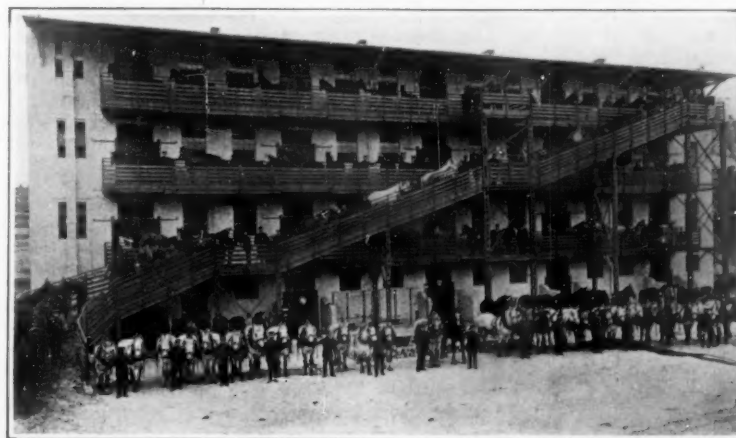
WHEN Mme. Curie arrives the middle of May she will bring her eldest daughter, aged twenty. Mlle. Irene Curie is one of her mother's ablest pupils and a faithful assistant in her laboratory. Mme. Curie's sister has also become a distinguished woman of science. This sister, a doctor of medicine, together with Kazimierz Dluski, is head of a sanitarium at beautiful Zakopane, in the Tatra Mountains. She has won recognition from the Polish republic for devoted and pa-



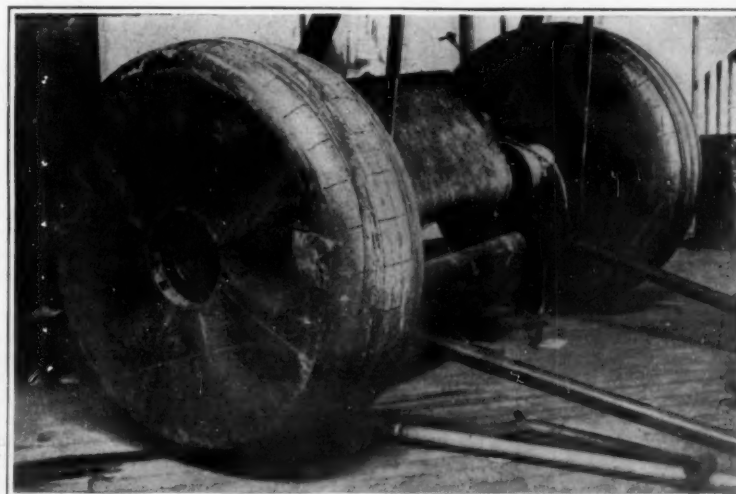
Despite its lightness and small dimensions, this de Pischof avionette is remarkably steady while in flight



Cyclecar equipped with six-horsepower motorcycle engine and steered by pulleys and cables



Hotel for horses located in the suburbs of Berlin, with its tenants and its uniformed attendants



Landing gear taken from a German airplane, showing the wire wheels fitted with wooden rims bound with steel bands

triotic service, and her associate, Dr. K. Dluski, represented General Pilsudski, Poland's President, at Versailles. Mme. Curie's brother, Dr. R. Sklodowski, is one of the leading physicians in Warsaw.

When the gram of radium which Mme. Curie is to receive at the hands of the women of America is once in her possession she will be responsible for the safety of the \$100,000 present. The greatest danger of all in the handling and transport of such a minute substance is that it might be lost, as once happened to the distinguished scientist, M. Becquerel, who let fall into a fold of his clothing, where it could not be found, an infinitesimal portion, which represented a considerable fraction of the whole supply then in France.

The French Radium Institute has been studying this phase of the American offer for several weeks, and after measuring the penetrating power of smaller particles of radium, scientists of the institute have decided that the gram must be divided into twelve or fifteen ampullae, according to a cablegram just received by the *New York Herald*. Each of these will be surrounded by a platinum sheath a thirty-second of an inch thick and encased in lead. The whole will then be sealed in a lead casket and placed in a separate safe in the ship's ice box.

Fast Climbing with a Freak Automobile

AT a recent hill climbing contest held in France a curious cyclecar or diminutive automobile, whichever you wish to call it, made over 60 miles an hour on 10 per cent grade. The machine, known as the "Spider" because of its light construction, is driven by a 6-horsepower, twin-cylinder, V-type motorcycle engine mounted at the rear. It is steered by pulleys and cables in very much the same manner as the usual airplane. The driver's legs extend into the hood of the machine while the passenger's legs and feet rest on side pieces.

A Hotel for Horses

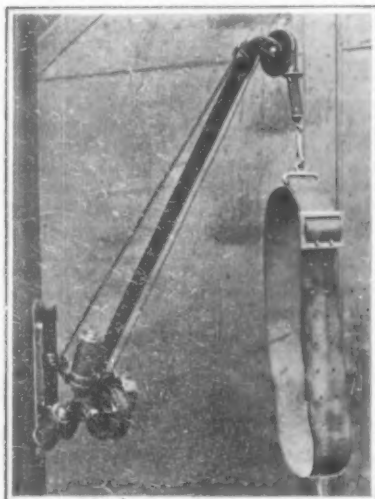
IN that section of Berlin known as Charlottenburg there is a veritable hotel for horses. This hotel—if we may be permitted to call even a de luxe stable a hotel—provides luxurious quarters for the horses of a Berlin bus company, as well as rents rooms by the day, week or year for horses visiting or staying permanently in the city. The structure, which is of brick, is three stories high. On each floor there is a roomy balcony running the full length of the building and available for exercising the horses. An inclined runway connects with all balconies, as shown in our illustration. A corps of uniformed attendants look after the horses and give them every care and attention that efficient hotel service can devise.

Wooden Wheels for Rubberless German Airplanes

DESPITE all that has been said of German substitutes for rubber, it appears that blockaded Germany of war-time days had to improvise ways and means of getting along without that important material. A case in point is tires for airplanes, of which the accompanying photograph is typical. Toward the end of the war numerous German airplanes were provided with all-metal landing wheels or wheels of wire and wood construction. The accompanying photograph shows one of the landing carriages of a large German airplane, equipped with wire wheels and wooden rims encircled by steel bands. Since the shock in landing is largely absorbed by the pneumatic tires, it follows that this improvised arrangement must have proved unsatisfactory and resulted in more breakage than is usually the case.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



The air cylinders force this hoist to ease its user to the ground gently in the event of fire

A Compressed-Air Fire Escape

AMONG recent German inventions is our good old friend the individual fire escape about which so many jokes have revolved. The present invention, however, has a feature of novelty that entitles it to mention here, and that suggests the possibility that perhaps it should be taken seriously. As our illustration shows, it is of the type which provides a hoist to lower its user to safety from the window, to the frame of which it must be attached in advance. The interesting item is the use of compressed air cylinders to ease the drop and make it at once safe and rapid. After duly attaching the belt, the user turns on the air, and sufficient resistance is afforded by the piston to the turning of the sheaves on which the cable runs to insure that he be deposited with sufficient gentleness to avoid broken bones. The entire apparatus weighs no more than 25 pounds, and is accordingly easily transportable.—By H. Herzberg.

Newest Bait Bucket

AN air chamber within this bait bucket for fishermen makes possible its floating in water, submerged to the rim only. There will be for this reason a constant circulation of fresh water for



A handy live-bait bucket which floats in water

the minnows. The cup seen on top of the bucket is for holding an immediate supply of bait only. This has a bottom which is also a float and which, by its buoyancy, keeps the opening closed against the entrance of other minnows.

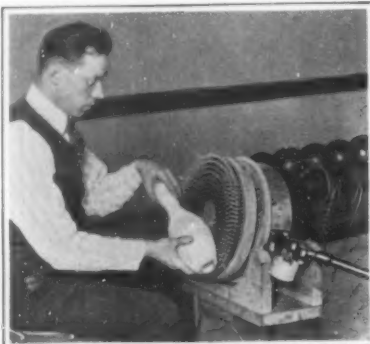
An Automatic-Stop Drill

THE portable grinder shown in the accompanying illustration is motor-driven, using either alternating or direct current, and automatically stops when not in use. This is due to the fact that the current contact functions through a spring lever in the handle which is released as soon as the pressure of the operator's grip is removed, much on the same order as the valve on a pneumatic hammer or on the same principle as the "dead man" grip controller used on many of our electric railways.

A portable drill of very much the same design is also available with the same style of control. In either equipment the motor has been designed to withstand severe use and overloading, for this class of service often calls for extremely heavy loads on the motor for short intervals.

New Pins from Old

ELECTRIC-DRIVEN rotary brushes are nothing new, but new uses for them are being found all the time. Our picture shows the use which an ingenious pin-boy in a big bowling alley has made of one which was installed, in the first instance, to keep the alley floors in prime shape; and it ought to contain



Renovating the bowler's pin with the electric floor-brush

a suggestion of some value in a good many other but similar directions.—By U. O. Underwood.

Motor Trucks and Road Wear

THERE is a special field of transportation in which the motor truck is the only logical means of conveyance. How large a field it is, is shown by the fact that 300,000,000 tons of material were shipped by truck in 1919. Suppose this freight were transported in one-ton trucks. It would mean that 900,000,000 tons of traffic (including weight of vehicles and cargo) would pass over the roads of this country. If transported in 7½-ton trucks the roads would have to bear only 600,000,000 tons of traffic. This is because the average one-ton truck carries two tons of vehicle weight for every ton of freight transported while in a 7½-ton truck this ratio is reduced to less than one ton of vehicle weight for each ton of freight capacity. Regardless of what form restrictive legislation may take the total

amount of material shipped in motor trucks in 1920 will obviously be greater than the total for 1919. This country is suffering from various kinds of shortages but they are almost all directly the result of inadequate transportation. Since no other transportation agency can now take the place of the motor truck in its own recognized sphere, it is obvious that every heavy duty truck barred from the roads will be replaced by several smaller trucks. The result will be increased road wear and increased cost of transportation. As practically all products of the farm and factory make some part of their journey from producer to consumer in motor trucks, it is necessary to make sure there is no other alternative before framing legislation which will increase motor transportation costs.

There are many fields of short distance light delivery in which the lighter truck is better adapted. However, when bulk hauling is considered, the light



Gripping the handle of this electric grinder starts the wheel

truck's greatest asset in comparison with its big brother is its speed. For a two-ton truck to transport material as economically as a heavy duty model it would be necessary for it to travel at three times the speed of the larger truck. Of course the light truck cannot do this but it does travel at a considerably higher normal speed. Its increased speed, however, produces road wear in excess of that caused by the heavy truck in spite of the fact that the latter is accomplishing far more. It has been definitely proved that increased speed causes more rapid road wear than increased weight. It is not necessary that the heavy duty truck resort to destructive road speeds in order to furnish economical transportation.

Tire width bears an equally important relation to comparative road wear. A steam roller for example is about the heaviest vehicle which passes over a highway, yet because of its broad road bearing surface its effect on the roadway is beneficial rather than harmful. Likewise weight in a motor truck is destructive only when not accompanied by a sufficient width of tire. The fact is well established that a load of 800 pounds per inch of tire surface is not damaging to an ordinary roadway and the heavy duty truck is always built to conform to this requirement. A 7½-ton truck has one inch of tire width for each 666 pounds of weight.

If restrictive motor truck legislation is necessary and it undoubtedly is, why not proceed on a basis which penalizes actual road wear rather than one which penalizes utility and determine by actual test and far reaching analysis just where the blame for excessive road wear belongs? Then and only then will the judgment be a permanent benefit to the growth of highway transportation and its relation to public welfare.



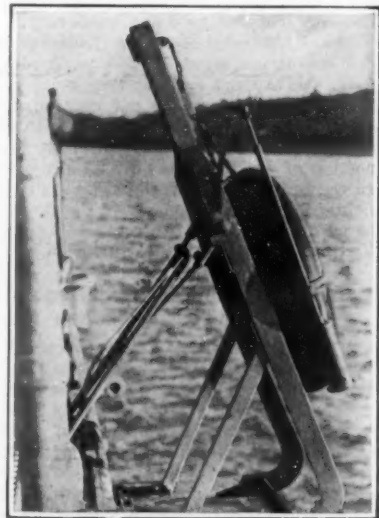
Shoe brush with the polish right on tap

The Polish in the Brush

IF one of your New Year resolutions was to shine them yourself, this combination brush and polish, all in one article, will make the work easier and keep your fingers from becoming smeared with polish. Beneath the metal cover of the brush is a tube of shoe polish much as dentifrice is put up. By turning the key which projects through the slot along the side, as much or as little of the polish as desired will find its way into the end of the tube projecting from the metal cover.—By K. H. Hamilton.

The Automatic Life Buoy

YOUR Uncle Samuel's big naval craft have just been outfitted with a new and interesting style of life buoy. The novel features of this buoy are two. In the first place, it is so installed on the ship that by the pressing of a button from the bridge, a number of the buoys are at once released and launched into the water. In the second place, as soon as a buoy strikes the sea, a big flare bursts out and burns until the buoy is picked up again. In this way, when the cry "Man overboard" goes up, it is expected to reduce to a practical zero the chances of the unfortunate sailor missing the buoys, or of the ship missing him.—By Ralph Howard.



The new life-buoy of the American Navy

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

AIRPLANE.—W. L. DENHAM, 1128 12th Ave. N. Birmingham, Ala. Among the objects of the invention is the provision of a machine embodying airplanes having rotation about an orbit or point stationary with respect to the body or fuselage of the machine in order to apply a direct lifting force and enable the machine to proceed to climb or descend, under control as desired, upon an even keel, or in other words without tilting as required in the present type of airplane.

MOTOR MOUNTING FOR AERIAL VEHICLES.—V. E. JOSSENBARGER, 4354 Prospect Ave., Los Angeles, Cal. The object of the invention is to provide a motor mounting of such form that the axes of the propeller may be shifted to shift the plane of the propeller and the direction of the pull, to overcome emergencies of every character, such as, for instance, to right the machine in nose dives, nose spins, tail spins, side slip, and for permitting the machine to be extricated from air pockets and to assist in rising and landing.

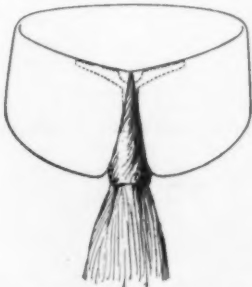
AIRPLANE.—C. H. GEORGI, 14 E. 30th St., New York, N. Y. This invention relates particularly to an arrangement of planes and adjusting means therefor, and has for an object to provide mechanism whereby the angle of incidence may be changed at any time, the structure being so formed that none of the parts of the airplane are weakened or reduced in efficiency. A further object is to provide means whereby an easy landing may be made, by a high speed machine, and a bracing effect produced at the time of landing or while in flight.

Pertaining to Apparel

ADJUSTABLE BELT.—T. JANSEN, 700 West End Ave., New York, N. Y. The invention relates to belts for wearing apparel and has particular reference to means for varying the effective length of the belt so as to fit it to persons of different sizes. Among the objects is to provide a belt having peculiarly housed resilient members, stop means being provided to prevent the over-stretching of these resilient members, and provision being made for complete separation in case of repair, or the like.

NECKTIE FORM.—L. F. CAUMONT, 98 3rd Ave., New York, N. Y. The general object of the invention is to provide a necktie form for use in forming four-in-hand knots by the individual user, even if unskilled in tying four-in-hand neckties, and more particularly the invention relates to a former for directly applying the formed tie with the former to the collar and securing the same to the collar button without passing the band of the necktie above the collar.

SOFT COLLAR HOLDER.—J. O'CONNOR, 437 W. 43rd St., New York, N. Y. This invention relates to a device for holding soft collars in a manner to maintain the collar in proper set. The general object is to provide a



A FRONT ELEVATION, SHOWING THE SOFT COLLAR HOLDER IN USE

soft collar holder comprising upper and lower sections adjustably connected, and at the same time to provide button engaging means in fixed relative position, and unaffected by the adjustment of the supporting wings or lateral arms for holding the collar flaps.

NECKTIE AND SECURING MEANS THEREFOR.—E. BLISS, 731 Plum St., Vineland, N. J. The invention relates to means on which the knot of a necktie is formed, said means embodying the elements for engaging the collar button and for entrance beneath the front of the collar. The general object of the invention is to provide a necktie and attaching

means of the indicated character, which is durable, said securing means being formed of wire.

Electrical Devices

AUTOMATIC DOOR OPENER.—C. F. YOUNG, 3952 Ludlow St., Philadelphia, Pa. The invention particularly relates to door openers applicable to garages. An object is to provide an electrically-controlled contrivance for automatically opening doors in which means are provided so that the door cannot stall during its movement. Another object is to provide a simple and inexpensive device which can be easily applied to existing doors of the swinging type.

DRY CELL BATTERY.—H. M. KORETZKY and B. H. TEITELBAUM, c/o Bright Star Battery Co., 310 Hudson St., New York, N. Y. This invention relates to dry cell batteries in which the electric agents of the battery are normally spaced from each other or inactive for an indefinite length of time, up to the time the battery is put into use, and whereby the devices are not subject to deterioration during the interval of time elapsing between the time of manufacture and the time of use.

TANK SIGNAL.—E. E. PIERCE, Hackley School, Tarrytown, N. Y. An object of the invention is to provide a signal device for gasoline and other tanks, which may have an indicating member on the front dash of an automobile or at any other convenient point, and electrically operated whenever the manually operated switch is closed for indicating the level of fuel in the supply tank, the electric current being used only when giving the signal.

TRANSMITTER.—M. R. MYERS, Afton Star Enterprise, Afton, Iowa. The invention has for its object to provide a transmitter especially adapted to withstand heavy currents of electricity such as are used in wireless telephony. A further object is to provide a transmitter that can be used from any angle and for this reason is especially adapted for use with flying machines.

FREQUENCY-SELECTING RECEIVING CIRCUIT.—F. E. PERNOT, c/o Cosmos Club, Washington, D. C. An object of the invention is to provide a receiving circuit tuned to receive one or more predetermined tone frequencies to the substantial exclusion of all other frequencies thereby preventing interference. A further object is to provide for the simultaneous reception at a single station of several tone frequencies from one or more sources.

GROUND CLAMP.—P. WINDMAN, 106 Kearney Ave., Perth Amboy, N. J. The general object of the invention is to provide a clamp for the purpose of grounding an electric conductor on a pipe or equivalent grounded element. A more specific object is the provision of a ground clamp formed of a strip of metal, one extremity of the strip being shaped into a socket for receiving the electric conductor, the point of juncture of the socket with the flat portion of the strip being so shaped as to give the desired rigidity to the socket to which the electric conductor is anchored.

RECORDING INSTRUMENT.—O. T. ALEXANDER, 1228 45th St., Altonpark, Tenn. The invention relates more particularly to an electrically-controlled recording device designed for use on electric pushing and leveling machines of by-product coke ovens and the like to record the time of, and the relative amount of, current in each horsepower required on each oven operated. A further object is to provide an instrument which in its dual capacity will register the time of pushing and the leveling operations as well as the current used.

Of Interest to Farmers

GRAIN DRIER.—W. PUTNAM and G. D. LONGMAN, 2019 Ryan St., Lake Charles, La. An object of this invention is to provide an apparatus which is designed to dry or cure an unlimited quantity of grain directly as it comes from the field and before it is threshed; it is especially adapted for curing rice, but may be used for other grain, resulting in the prevention of great loss from wet weather.

STOCK LIFT.—O. E. HATCH, Box 465, Davenport, Iowa. The invention relates to a stock lifter which is readily portable so that it may be set up at any place desired, to lift and support an animal. An object is

to provide a construction of hammock with a frame supporting and guiding the same, and provide levers at the corners of the frame which can be conveniently manipulated to give the desired elevation.

GATE.—F. A. GARCIA, R.F.D. No. 2, Box 137A, Pueblo, Cal. The invention has for its object to provide a gate adapted to be used



A SECTIONAL VIEW OF THE GATE

within a pit, to form a covering or supporting surface level with the top of the pit, or to form an open-work structure for deterring the passage of stock and the like; the structure may be quickly thrown into or out of position for the passage of vehicles or for proving an obstruction for stock.

Of General Interest

ALARM CLOCK.—C. W. WALLER, 5414 So. Wells St., Chicago, Ill. The object of this invention is to provide mechanism for use in connection with an alarm clock for converting such clock into a noiseless alarm, whose sound will carry only to one person whom it is de-



SHOWING THE CLOCK IN USE

sired to waken. To accomplish this ear pieces are engaged with such persons' ears that the sound vibrators may be carried by a flexible tube directly to the users' ears, the clock being constructed in such manner as to be practically noiseless to others.

PORT SCREEN.—T. J. BOYAN, c/o W. B. Roe, 55 Bayswater St., Boston, Mass. The purpose of the invention is to provide a port-hole screen closure to prevent the entrance of insects, the closure being used in combination with a ship's port hole, and port hole cover so that the cover may be dogged down with the screen closure in position. A further object is to make a screen insert construction in the form of a plug capable of being easily inserted or removed.

COMPOUND FOR THE AUTOMATIC REMOVAL OF COPPER FROM ORDNANCE.—A. E. A. DAGORY, Bois Colombes, Seine, Avenue Robert Bain, No. 8, France. The invention relates to a compound for automatically freeing guns of all calibers from the copper which is deposited, during the firing, in the interior of the bore. The compound used consists of an explosive material and an alloy of tin 55 per cent and lead, 45 per cent.

CAMERA.—N. E. BROWN, 22 Washington St., Grand Haven, Mich. The purpose of the invention is to provide a camera which can be built up cheaply of cardboard or other sheet material, cut in blank form in such a manner that it may be folded flat to remain convenient for carrying until required for use when it may be formed into a temporary camera by joining the edges with flexible gummed binding strips. The camera is so constructed as to use the well-known daylight-loading photographic film packs.

WATERPROOF CIGARETTE CASE.—S. V. ROOS and M. JOSEPHS, 715 W. 170th St., New York, N. Y. An object of the invention is to produce a moisture and waterproof cigarette, cigar and match case for bathers' use in order that swimmers and bathers may be able to conveniently carry such articles. A further object is to provide such a case, which will be comparatively inexpensive, strong and light in weight.

FOOD PRODUCT AND PROCESS OF MAKING SAME.—R. DE O. McDILL, Box 198, Tampa, Fla. Two patents of a similar nature have been granted to this inventor. The in-

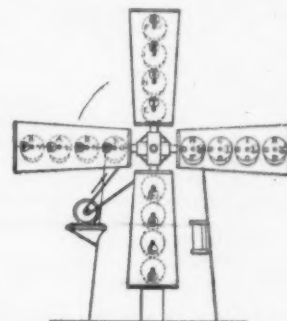
ventions relate to the preparation of a pomace in a dry state from fruits, to be used in making marshmallows, jams, and jellies, so that all that is required is to cook and soak the pomace, strain off the juice and cook the resultant juice with sugar in the manufacture of jelly. In the manufacture of marmalade and jam the operation is the same except that the pomace is incorporated when cooked with the sugar as in the standard practice in making such foods from fresh fruits.

ATTACHMENT FOR BATHTUBS.—I. T. SKILES, 3703 E. 10th St., Long Beach, Cal. The invention has for its object to provide mechanism in connection with the outlets of a bathtub for simultaneously controlling the waste and the discharge, and so connected that when the waste is open the discharge is closed and when the discharge is open the waste is closed.

STIRRUP LEATHER FASTENER FOR SADDLES.—C. B. SETTLES, Delphia, Mont. One of the principal objects of this invention is to provide a metal fastener for use particularly in connection with wide leathers found commonly on stock saddles, for quickly and adjustably connecting the ends of the stirrup leathers, thereby doing away with the use of the leather strings or laces usually employed for this purpose.

MANUFACTURE OF HYDROGEN BY MEANS OF SILICON AND ITS ALLOYS.—G. F. JAUBERT, 155 Boulevard Malesherbes, Paris, France. According to this invention the method of manufacturing hydrogen consists in mixing equal volumes of ferro-silicon in the state of powder and water, in stirring the said mixture in order to eliminate phosphides, and in injecting the semi-pasty liquid of ferro-silicon obtained into a hydrogen generator containing caustic alkali, either above or below the alkaline liquid.

ADVERTISING DEVICE.—C. D. BOWERS, 318 W. 57th St., New York, N. Y. The special object of the invention is the provision of a movable device simulating a Dutch windmill, upon each arm or blade of which are pivoted a series of disks, each disk bearing a



A FRONT ELEVATION OF THE DEVICE

plurality of characters adapted to be brought into display position in succession as a result of the revolution of the disk with the arm around the axis of the wheel and the simultaneous rotation of each disk on its own axis.

COMBINATION DRIPPER AND STEEPER.—G. H. NICHOLLS, Box 536, Beaumont, Texas. The object of this invention is to provide a device for preparing beverages such as tea and coffee, wherein a strainer is provided for supporting the material to be steeped, and the said strainer having means for engaging the top of a tea or coffee pot to support the strainer with the material to be steeped in the water or out of the same.

SUPPORT OR HOLDER.—R. F. FERGUSON, Northville, Mich. This invention has for its object to provide a device of the character specified, of ornamental construction, adapted for supporting a safety razor and the blades in convenient position for use when desired, and which may be suspended from the wall or stood upon a dressing table or the like.

OUTFIT FOR PRODUCING BEVERAGES.—H. SCHNACKENBERG, Cresco, Pa. The invention relates to an outfit comprising individual drinking cups as well as ingredients for the production of an aerated or other soft drink or the like, by the addition of water. The object is to provide a unit in which the two nested

cups form a chamber containing the ingredients for the beverage, the chamber being airtight and moist proof.

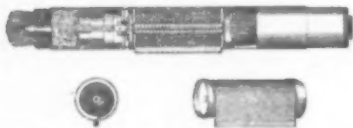
REEL HOLDER.—C. J. ANDERSON, Box 255, Fort Bragg, Cal. The invention has particular reference to a device for holding fish reels. The prime object is to provide a holder which is so constructed as to render the same adapted to readily receive a winding reel so that the line may be wound upon the reel in an easy manner, and that the reel may be interchangeable.

CHEESE CUTTER.—I. S. KARRAS and L. H. BRIDWELL, 109 Cypress St., Brinkley, Ark. Among the objects of the invention is to provide a clean and sanitary device supporting the cheese in an enclosed receptacle, and to provide means for cutting the cheese in slices as may be desired. The table on which the cheese is supported is provided with rotary movement, and V shaped recess through which the cheese falls as cut.

FOUNTAIN MARKING BRUSH.—M. M. SHACKITT, 1922 Pitkin Ave., Brooklyn, N. Y. Among the objects of the invention is to provide a fountain brush more especially designed for use in marking boxes, cases, packages or other articles, and arranged to enable the user to readily carry the device about on his person for use whenever necessary. Another object is to enable the user to temporarily support the brush and thereby have the free use of both his hands.

SEDIMENT REMOVER.—D. AKERS, 301 Broad St., Carlstadt, N. J. The invention relates to plumbing equipments in the form of a removable strainer. An object is to provide a sediment remover more particularly for use in connection with hot water boilers. The device is comparatively inexpensive to manufacture and may be quickly installed for use on hot water systems generally found in the home.

SHOE POLISHING DEVICE.—C. VANDERBILT, JR., c/o Ten Eyck Hotel, Albany, N. Y. An object of the invention is to provide a device which is relatively small and compact, and may be conveniently carried in the pocket, or in a bag while traveling. A further object is to provide a device having mounting for a polishing strip and for brushes or daubers so



A SECTION VIEW OF THE INVENTION, AND PERSPECTIVE VIEW OF POLISHING STRIP

that all of the parts may be conveniently positioned for use, and when not desired for use will be enclosed so that they will be neat and clean for handling and will not injure or soil other articles.

CONCRETE WALL CONSTRUCTION.—W. C. BECKHOUT, Lincoln Station, Yonkers, N. Y. Among the objects of this invention is to provide a wall in which a minimum of concrete is employed and which will be quickly dried out by reason of the air circulation therethrough. A further object is to provide a wall which can be constructed without forms of any kind, and which will have an interior drainage and ventilating system.

SAFETY CLASP FOR PINS, BUTTONS AND THE LIKE.—F. DRISLER, 206 Broadway, New York, N. Y. The invention relates to holding devices for badges and other similar devices, and has for its object to provide a construction which will be very effective when in position, but which is easily applied and removed. Another object is to provide a safety holder which will hold the pin or button in place without changing the position or disturbing its usual appearance.

SAFETY RAZOR.—I. CLAIR, 1035 53rd St., Brooklyn, N. Y. The invention aims more particularly to provide a device in which all possibility of the user cutting himself is eliminated. A further object is the provision of means whereby the corners of the razor are protected, and by reason of such guard the corners are kept out of cutting contact with the surface of the skin at all times, although the cutting blade is in proper contact with the surface of the skin.

WALL CONSTRUCTION.—H. J. LAFONTAINE, 5641 Cottage Grove Ave., Chicago, Ill. An object of this invention is to provide a wall construction which is made up of hardened slabs of plastic material, these slabs being secured to suitable supports, so as to form a wall at relatively low cost. A further object

is to provide a construction in which the slabs are overlapped in such a manner as to prevent the passage of moisture between the joints.

FLYING TARGET.—A. McMILLAN, 40 Bayard Lane, Princeton, N. J. An object of the invention is to provide a flying target which can be used over and over again without its utility being impaired. Another object resides in the provision of means whereby the target when struck by shot will be separated into several parts and thereby fall indicating a hit, at the same time it is so constructed as to be readily reassembled without damage.

TAG HOLDER.—J. J. WOLFE, 227 Alexander Ave., New York, N. Y. An object of the invention is to provide a holding device for tags, identification cards and the like, means being provided for thoroughly protecting the tag against injury. A further object is to



A PLAN VIEW, PARTS BEING BROKEN AWAY TO DISCLOSE THE INVENTION

provide a construction which may be placed on almost any part of a trunk or other article, and will at the same time be out of the way, although permitting of ready insertion or removal of the tag, but preventing accidental loss thereof.

LOCKING DEVICE FOR INDEX CARDS.—H. C. JONES, c/o Lemon Cove Hotel, Lemon Cove, Cal. The purpose of the invention is the provision of index cards having locking means carried thereby for positively securing the card to the rod in a manner to eliminate the necessity of completely or partly removing the rod from the filing case in effecting the insertion or removal of a card.

INTERLOCKING HEAVY SERVICE BLOCK FLOORING.—J. D. BUTLER 6650 City Ave., Philadelphia, Pa. The invention relates to paving adapted for extreme strength under heavy service. Among the objects is to provide means for the expeditious and permanent laying of wooden blocks with the grain arranged vertically, and interlocking mechanism for the wooden blocks comprising tongue and slot members adapted for longitudinal mating, each block being fitted on opposite sides with a pair of said interlocking members.

DIVING APPARATUS.—A. E. CHRISHOLM, c/o Chesley Tug and Barge Co., 4 Ferry Bldg., Seattle, Wash. This invention is especially adapted for use in deep sea diving. An important object is to provide apparatus which is adapted to be suspended and lowered from a ship or barge in such manner that it will not partake of improper turning movement, and will be shifted in accordance with the movements of the ship or barge. A holding or grappling means is provided which may be easily operated from the interior of the casing of the apparatus.

VANITY CASE FOR HANDBAGS.—M. WIENER, c/o Wiener Bros., 325 5th Ave., New York, N. Y. It is the primary object of this invention to construct a vanity case in such manner that the same is permanently secured within a handbag. It is a further object to pivotally mount a vanity case within a bag in such manner that movement of the case about its pivotal point will effect the opening of the case.

ROD SPLICER.—C. A. NELSON, Carver, Minn. The invention relates more particularly to splicing reinforcing rods for concrete. The object is to supply a rigid splice whereby there is no danger of slipping when cast with concrete. Another object is to provide a splice which can be quickly adjusted and then firmly clamped.

SLIDING NAME REGISTER.—L. M. A. HAUGHWOUT, c/o Essenstein & Haughwout, 2 Rector St., New York, N. Y. The object of the invention is to provide a sliding name register which indicates the presence or absence of the person indicated on the name plate, in large assemblies such as schools, churches, offices, hotels and manufacturing concerns, indicating the names of all persons present in one column and those absent in another column.

Hardware and Tools

LIFTER FOR COOKING VESSELS.—H. L. ANGUS, Inverness, Mont. A purpose of this invention is the provision of a lifter of simple, durable and efficient construction which includes cooperating jaws that are adapted to be actuated to firmly embrace a vessel for

manually lifting the same, one of such jaws being locked when in the operative position to prevent the vessel accidentally slipping while being carried by the lifter.

HOSE COUPLING.—L. STEIN and L. BRUMER, address B. Hartstein, 209 Broadway, New York, N. Y. The prime object of the invention is to so construct a hose clamp that various degrees of adjustment may be had, thus adapting the device to hose couplings of various sizes. It is a further object to so construct the clamp that it will have contact with the hose throughout its entire inner circumference thus insuring a tight joint between the hose and the coupling member.

FAUCET.—H. A. LINET, 2 New York Ave., Brooklyn, N. Y. An object of this invention is to provide a faucet of simple construction which may be opened by an upward pressure of the hand so that the hand is wet as it opens the faucet. A further object is to provide a faucet which may also be opened continuously for a steady stream of water.

LOCK.—C. LIBERMAN, 1732 Madison Ave., New York, N. Y. This invention has for its object to provide a lock for use on doors, trunks and other articles, and arranged to prevent unauthorized persons from pushing the bolt back out of the locking position by the insertion and manipulation of thin blades, tools or other implements. The device is simple and not liable to get easily out of order.

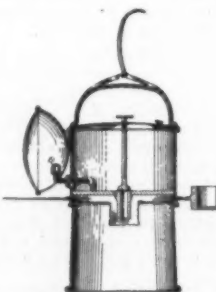
CONCEALED FRENCH CASEMENT LOCK.—C. J. HAGSTROM, 25 Maple Ave., Glen Cove, L. I., N. Y. Among the objects of the invention is to provide a lock for French casement doors or windows, all parts of which are practically concealed even though devices are provided for locking a door or window at both top and bottom as well as intermediate thereof, the part carried by one door being adapted to be operated either by a key or knob, and the parts carried by the other door being adapted to be operated by the insertion of a finger through the striking edge of the latter after the first door is opened.

SHELF PRICE TAG HOLDER.—E. J. COOK, 110 N. Cleveland Ave., Spokane, Wash. The invention has for its object to provide a tag holder formed from sheet metal and capable of being placed on any shelf, and having means for supporting a price tag to indicate the price of goods adjacent to the tag, said tag being adapted to be held by the goods on the shelf.

GASOLINE TORCH.—M. BAYERS, 1004 Simpson St., Bronx, New York, N. Y. This invention relates to portable heating appliances or torches such as are commonly used by plumbers, steam fitters or the like, and has particular reference to gasoline torches with special means for supporting the torch in position upon the tank for use in a manner similar to the use of an ordinary torch, but with adjustability of the torch as to various angles, or for the manipulation of the torch at any desired distance from the tank into places ordinarily inaccessible.

Heating and Lighting

MINER'S LAMP.—E. M. ERICKSON, Box 108, Ray, Arizona. The object of the invention is to provide a simple, strong and efficient miner's lamp, wherein all the parts are made detachable for quick and easy cleaning. The device is composed of upper and lower sec-



A VERTICAL SECTION OF THE LAMP

tions, having a gas-tight joint; a partition is arranged between the water compartment and the carbide compartment, the two being connected by a tube.

OIL BURNER.—J. C. EDMUND, c/o Amos Bird Co., Shanghai, China. An object of the invention is to provide means for vaporizing the oil, and a burner lip or tip which permits a free commingling of the vapor and steam to insure a proper burning action. A further object is to provide a burner which is capable of receiving burner tips having different arrangements of grooves and recesses so as to

permit of an adjustment in accordance with the fuel oil and steam employed.

Machines and Mechanical Devices

MACHINE GUN.—J. F. O'MALLEY, Box 323, Mt. Vernon, N. Y. The object of the invention is to provide a machine gun of the type described in Letters Patent No. 1307316, granted to the same inventor June 7, 1919. The present invention relates to an improved arrangement for supplying the cartridges to the barrel in use at the time from an intermittently revolving magazine wheel instead of from a cartridge belt.

CENTRIFUGAL PUMP.—K. O. MJOLESNES, Nashwank, Minn. This invention has for its object to provide mechanism in connection with centrifugal pumps for permitting the pump to be repaired when it becomes worn without requiring extensive operations on the pump, merely by removing the worn portion and substituting a new portion.

FILM DEVELOPING DEVICE.—F. E. SMITH, 927 Grant Ave., Bronx, N. Y. The invention relates more particularly to a mechanical device for carrying and conducting a film during the developing process. Among the objects is to provide a carrying means which will positively grip the film throughout its travel and hold it in spaced relation from other parts, thus preventing the emulsion side of the film from becoming scratched or otherwise injured, and will eliminate the necessity of having to splice a film in case the same breaks.

FIRE IGNITER.—H. PIERCE, Box 166, Paragould, Ark. An object of the invention is to provide mechanism for igniting fires at a distance. A further object is to provide a trigger operated match lighter which may be placed at the point where the fire is to be lighted and controlled by an operator who may be some distance away. The device is practical and durable, and may be manufactured at a relatively low cost.

GARAGE SHOP MOTOR CRANKING MACHINE.—M. B. WALKER and G. A. MARTIN, c/o La Grange Motor Co., La Grange, N. C. An important object of this invention is to provide an apparatus through which power may be applied to the traction wheels of an automobile to start the engine, especially when the engine bearings are new, or whenever the engine, for any reason, does not start or run smoothly and easily.

CHECK WRITING AND NUMBERING MACHINE.—C. H. WOLFE and H. G. ALLEN, 721 9th Ave., Seattle, Wash. The invention relates particularly to a machine by means of which the amount and number of the check as well as the name of the payor may be filled in in such manner as to successfully defeat erasure or change, the object being to provide a simple apparatus which is readily adjustable, and which will emboss as well as print for the above purpose.

FINISHING MACHINE FOR PILE FABRICS.

—T. C. BARKER, c/o Carl C. Maltmann, Jr., Astoria Silk Works, 727 10th Ave., Long Island City, N. Y. The invention relates to cloth finishing and its object is to provide a machine for pile fabrics, such as mohairs and the like, and arranged to insure thorough combing and batting of the pile with a view to remove all extraneous matter and to cause the pile to stand up permanently. Another object is to prevent the formation of streaks, to permit of combing and batting a piece of pile fabric of usual length in a comparatively short time, and to dispense with skilled labor.

COCOANUT HUSKER.—F. N. FONS, C. Del Carmen, E De Camp, Mexico. The invention pertains more particularly to a manually operated machine for removing the husks of coconuts. A further object is to provide means for removing the nut from the husk after the husk has been severed, and means for automatically removing the husk from the machine. A still further object is to adapt the machine for use with nuts of various sizes.

Medical Devices

TONSIL SNARE.—C. R. STORZ, P. O. Box 348, Matawan, N. J. The device is intended for use by surgeons in removing the tonsils, its chief object is to simplify the operation of removing the tonsils by an automatic clutch action and loop; this wire loop is tightened by the action of a screw rod whereby the screw rod serves to actuate a slide thus constricting the wire loop until the tonsil is severed thereby.

DENTAL CUSP.—J. HOMER, c/o Thos. A. J. Grady, 704 Parker St., Roxbury, Mass. The invention more particularly relates to cusps for crowns, bridge work and porcelain-faced or other teeth, an object being to provide a cusp

(Continued on page 295)

The Civil War Carved in Granite

(Continued from page 285)

recognition by any one versed in the military history of the United States. Each soldier will be fifty feet in height, and will be distinct to the observer five miles away.

The base line of the troops will be two hundred feet from the ground. The main figures will be carved in complete relief and will stand out from the stone. That means that yards and yards of solid granite will have to be slowly and painstakingly cut away to bring them out. The execution of the other figures will be such that some of them will fade into bas-relief and still others into mere sketches, although all are to be full size. The whole effect will be such that it will appear as if the soldiers came out of the mountain, and that, if the mountain were broken up, by some chance, it would be found full of men.

The first seven figures of the army will be a mounted group representing cavalry led by the three men who were probably the most striking characters in the Confederacy: Robert E. Lee, "Stonewall" Jackson, and President Jefferson Davis. Next will come a troop of cavalry, the vanguard of the army, in close formation, for even in defeat the army of the South, which the cavalry typified, held its spirit high. Trudging masses of infantry will follow, and far over the shoulder of the mountain, seeming to stretch over miles of fields, will come rumbling batteries of artillery.

On top of the mountain there has been installed a hoist from which steel cables will run down the side of the cliff. Much rope pulling and attendant danger over the steep sides of the cliff accompanied the installation. This aspect of the work required the labor of fearless men who could stand on brink and balance heavy wooden supports, because the nature of the formation prevented the use of derricks on top.

Much difficulty will accompany the adjustment of transverse cables over the face of the cliff. Such cables will be necessary to permit the lowering of the steel cages in which Mr. Borglum and his corps of artists will do their work. Every inch of the face of the mountain will be covered by the cages, so that every part of the rock may be molded to conform with the general picture.

What has added to the task of the laborers is the desire of the sculptor not to have the cages too near the granite, so that there should be no possibility of scraping it, for damage done this natural canvas is well-nigh irreparable. The wooden structure at the brink, therefore, had to overhang the mountain by several feet. In driving the stakes to keep this structure—a stairway affair—in place, care had to be taken to damage the rock only in such a way that repair could be made without leaving inharmonious gashes after the completion of the task.

At the base of the mountain, a Memorial Hall will be carved out of solid rock. This hall will contain a chamber for each state of the old Confederacy for the preservation of records, a museum in which relics of the fast-fading reminders of the struggle may be exhibited, and for similar purposes. The hall will have corridors and massive bronze doors. Everything will be on a scale to compare with the huge army on the side of the mountain. The hall and its superstructure will rival the Washington Monument as the biggest stone spectacle in the country, but the Washington Monument, of course, is an architectural triumph rather than a sculptural one.

About three thousand acres of land around the mountain, now wooded for the most part, will be acquired for park purposes; that is, more than 4 square miles of territory will set the army off from the rest of the landscape. Beautiful drives

will be laid out, and a lake will be created. Plans are already being made for several memorial gates.

Some Special Uses of Redwood

(Continued from page 286)

the Mare Island Navy Yard. For industrial plant flooring purposes, redwood blocks are usually dipped in hot asphaltum before laying, and grouted after laying. For mercantile establishments, offices, schools and other structures, the blocks are laid plain, with tight joints, the blocks glued together and sanded perfectly smooth, and the surface stained or varnished.

Redwood blocks, when used for street paving, are dipped in boiling asphaltum cement, which permeates into the wood fiber about a quarter of an inch. The process serves to seal the blocks against moisture, rendering them antiseptic, and of cementing together the end fibers of the wood, which become tough and exceedingly resistant to traffic abrasion. The blocks are laid rather loosely, with interstices sufficient to admit of free inflow of hot asphaltum cement, which is applied immediately after block-laying. This cements the blocks together into a solid structure, and also covers the surface with a heavy paint coat of asphaltum which absorbs the sand coating spread immediately after grouting. The wooden blocks provide a firm foundation for the thin skin of asphaltum on top, and as this is worn away it is easily and cheaply renewed.

Redwood makes a superior stave for pipe. There are many stave pipe lines in operation today that have been in continuous service for 30 years or more, and that show no appreciable depreciation. The original installations made in 1886 are still in practically as good condition as when installed, and it is estimated that the average life of a well-built continuous stave redwood pipe is from 60 to 75 years.

Rails and Railroads

(Continued from page 287)

in a wide variety of fields too numerous to mention in this article.

The various striking uses of discarded steel rails are depicted in our drawing on the opening page of this issue, together with the most striking figures of the magnitude of our track relaying industry.

In short, it is next to impossible to compass the well-nigh innumerable ways in which the material from old rails can be put to use by reshaping it. Because our trunk lines insist upon sound steel of a high grade in the first place therefore the rerolling mills get better basic material from the discarded rails than they would be able to buy at the same price new from the steel plants. Thus, thanks to the enterprise of the dealer in secondary metals, old rails continue to be of value long after they have ceased to be fit to hold a position in any of the tracks of our trunk lines, and most of us are the beneficiaries of this conservation either directly or indirectly. Millions of dollars yearly are saved by this procedure, and requirements are met and wants are supplied that it would otherwise be difficult to satisfy.

Two Hundred Thousand Photographs Per Minute

(Continued from page 288)

fast an exposure will the chemical sensitiveness of the film stand? It is possible to make a picture, with modern film, in the 1/2600 part of a second. As a matter of fact, it is possible to make pictures in the 1/3500 part of a second, which means 3,500 pictures per second or 210,000 pictures per minute.

The Jenkins projector has no shutter. The ring prism operates in front of the film, behind the lens. The picture is impressed upon the film during the move-

(Continued on page 299)

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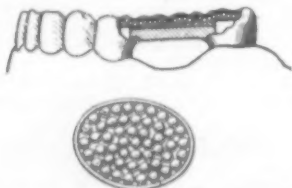
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PTL-2-21

RECENTLY PATENTED INVENTIONS

(Continued from page 296)

in which relatively small spherical metal particles, such as "Boston Balls," known as "B. R.'s" are employed, said balls being secured



A PLAN VIEW, AND INVENTION AS APPLIED TO BRIDGE WORK

in the cusp of the teeth or crown and preferably located under the metal of the crown so as to provide a bearing which can readily be shaped to the proper cusp of masticating surface, thus reducing to a minimum the labor of properly shaping the outer portion of the crown.

Musical Devices

REPRODUCER FOR TALKING MACHINES.—J. W. KAUFMANN, 1730 N. Monroe St., Baltimore, Md. It is a purpose of this invention to provide a reproducer in which the resilient member between the needle and the diaphragm is mounted to materially increase its responsiveness to the vibrations of the needle and to amplify such vibrations by allowing the use of resilient members of greater rigidity. The device can be used on records having vertical undulations as well as those formed with horizontal undulations.

Prime Movers and Their Accessories

SPRAY NOZZLE FOR VERTICAL DIESEL ENGINES.—D. O. BARRETT, Chapman Flats, 46½ W. High St., Springfield, Ohio. This invention has for its object to provide a construction wherein the oil may be sprayed into the engine under any desired pressure without placing the main supply of oil under any appreciable pressure. A further object is to provide a nozzle for Diesel engines in which means are provided for supplying a measured quantity of oil to the engine at intervals, same being mixed with air at a comparatively high pressure.

INTERNAL COMBUSTION ENGINE.—O. G. ERICKSON, 1229 Majestic Bldg., Detroit, Mich. This invention has for its object to provide a two-cycle internal combustion engine, embodying the combination of piston structure and by-pass arrangement whereby the fresh gas is initially compressed and becomes the agent whereby the gas of the previously burnt charge is expelled. A further object is to provide an engine having a dual arrangement of intake and exhaust valves, by use of which the gas is enabled to pass with greater facility.

Railways and Their Accessories

RAIL JOINT.—G. J. MURPHY, Baradero, F.C.C.A., Buenos Aires, Argentina. The general object of the invention is to provide joint elements to insure the free expansion and contraction of the rails under changes of temperature, and the maintaining automatically of the joint bolts at right angles to the rails without straining the bolts, and to prevent jars or shocks as the car passes over the joint.

MINE TROLLEY.—R. G. WILSON, Davis, W. Va. The invention relates generally to trolley pole supports and more particularly to mine trolleys. The object is to provide a rapidly reversible pole by longitudinally sliding the same, and which need not be rotated for this purpose, and which is capable of ready release adjustment and resetting with the minimum loss of time.

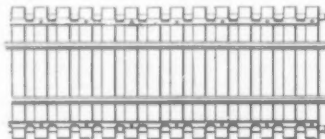
INTERLINE TICKET GUIDE.—O. S. PAYZANT, c/o Alfred Fullheimer, 7 E. 42nd St., New York, N. Y. This inventor has been granted two patents of a similar nature, the general objects being to provide holding members or guides for ticket cabinets of railways and the like, and to provide a construction which can be used with any size ticket and hold the same in proper position so that only one ticket can be removed at a time. Another object is to provide a cabinet and guide for either cardboard tickets or folded tickets, wherein the tickets are held in proper place, but are capable of bending regardless of their thickness or number of folds. A still further object is to provide a cabinet which is applicable for use with any quantity of tickets.

SWITCH STAND.—F. A. CANTWELL, Frankfort, Kan. An object of the invention is to provide a switch stand which is simple and of durable construction in which the signaling

means or target is in position to indicate danger at all times, except when the operating parts of the switch stand are locked in position to maintain the switch points set for main line.

SWITCH OPERATING AND LOCKING DEVICE.—J. L. BEIL, 302 Main St., Galena, Ill. This invention has for its object to provide a positive locking device which will hold the switch points in position against the rails when operated in an ordinary manner, and which will not allow the switch point to rebound from the rail when thrown too forcibly against same, nor allow the switch to open by a backward movement of the throw bar before the switch is completely closed, thus creating a condition liable to cause wrecks.

GUARD RAIL FOR RAILWAY BRIDGE.—W. H. ELLIS, c/o Supt. B. & B. Dept. N. P. Railway, Cheyenne, Wyo. A particular purpose of the invention is to provide a simple and inexpensive guard rail which effectively

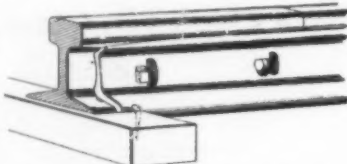


A TOP PLAN VIEW OF BRIDGE WITH GUARD RAIL APPLIED AND DETAIL

secures the deck ties in proper spaced relation on the girders, and which permits removal and replacing thereof when substituting new ties without detriment to the guard rails.

CRANK ASSEMBLY.—J. L. BEIL and W. J. O'NEILL, address J. L. Beil, 302 Main St., Galena, Ill. An object of the invention is to provide a crank assembly for ground connections for interlocking movements, as for instance, in railway switch apparatus, having means for preventing play between the moving parts while permitting free functional operation thereof, whereby the length of service is greatly extended.

RAILWAY JOINT LOCK.—W. M. READ, Aitkin, Minn. An object of the invention is to provide fish plates adapted to be arranged on opposite sides of the rails at the joints, each plate having a portion which extends inwardly beneath the rail to near the center, and has at each end a downward extension



A PERSPECTIVE VIEW OF THE JOINT

for engaging the tie to prevent longitudinal movement of the plate, and wherein means of connecting the fish plates is provided, together with means for preventing release.

RAIL CHAIR.—J. B. ARENDS, Onida, So. Dak. The invention relates to that type of rail joint known as a rail chair, the primary object is the provision of a joint of this nature which will eliminate the necessity of connecting bolts, and the usual difficulties encountered both in the application and removal of such bolts as well as the danger of loosening. A further object is to provide a rail chair which will effectively support the joint and allow for expansion and contraction.

Pertaining to Recreation

PLANCHETTE.—N. E. GOLDBERG, 22 E. 89th St., New York, N. Y. The invention relates to games and toys and its object is to provide a planchette arranged to enable two persons seated opposite each other to simultaneously manipulate a movable table without the persons being able to look at each other, thus heightening the effect when using the planchette for answering the questions.

AMUSEMENT DEVICE.—F. E. GUILD, 3212 Aner Ave., Milwaukee, Wis. This invention has for its object to provide a device wherein a series of cars is provided, and a trackway upon which the cars have guided movement in an endless loop, and wherein a variety of movements is imparted to the car during its passage, the trackway having at each end a turntable to which the cars are automatically connected and disconnected in their passage.

AMUSEMENT APPARATUS.—F. R. CHESTER, 1109 N. Warmasser Drive, Ashbury Park, N. J. The invention relates to amusement ap-

paratus of the racing type. The object is to provide an apparatus for use in pleasure resorts and other places of amusement, and arranged to afford the players and the onlookers considerable amusement and to require skill on the part of the players to successfully play the game in a short time.

PUZZLE.—M. PEAK, c/o A. T. & S. F. Ry. Offices, Newton, Kan. The purpose of the invention is to provide a puzzle in which a pair of pens or enclosures are provided made up of a plurality of arcuate flanges arranged to provide a plurality of circular channels communicating with each other at different points so as to render it extremely difficult to manipulate the board to direct spheres from the pen into a central pen or goal interposed between the two pens.

Pertaining to Vehicles

AUTOMOBILE.—F. O. MACKAY, Box 1402, El Paso, Texas. This invention has for its object to provide means in connection with automobiles, for providing mechanism which may be extended to form a tent bed, or folded into small compass, and wherein the folding bed may be utilized to store camp equipment when not used as a bed. The device is intended for use as an extension to the rear of the car.

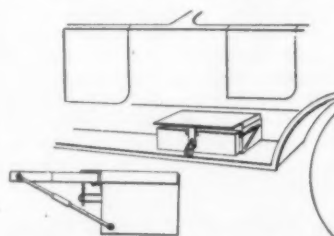
ANTISLIPPING DEVICE.—J. D. ROSS, 815 10th St., N. W., Washington, D. C. The object of this invention is to provide a non-skid chain which is of extremely simple and durable construction and highly effective in operation to maintain the requisite degree of traction between the wheels of the vehicle and the roadway, and which is effective at all times to prevent slipping or other undesirable motion of the wheels and vehicle.

TIRE CLEANING APPARATUS.—H. G. BALLOU, 737 S. Westlake Ave., Los Angeles, Cal. The particular object of the invention is to provide a machine for cleaning both the interior and exterior surfaces of casings of tires of the pneumatic type. A further object is to provide a machine which is automatic in its operation by means of which the brush in addition to its rotary cleaning motion may be given a vibratory motion to facilitate the removal of the residue of the cleaning operation.

DEMOUNTABLE RIM.—J. SIEVEN, 151 4th Ave., Brooklyn, N. Y. This invention more specifically has relation to separable or knock-down rims of the demountable class for pneumatic tires used on motor car wheels. The invention provides a demountable rim built in separable sections having positive locking means for holding the sections together, the arrangement being such as will enable the rapid removal or fitting up of a tire on the rim.

TIRE.—R. W. WOOD, Richwood, Ohio. An object of the invention is to provide within the ordinary shoe an expandable element sustaining to shoe in extended formation, and provide in the shoe a contractile element for clamping the shoe around the rim. A further object is to provide a tire which dispenses with the necessity for an inner inflated tube which causes the shoe to flatten when the tube is punctured or there is a blow-out.

COMBINED RECEPTACLE AND TABLE.—H. HARRILD, 730 So. Maple St., Spokane, Wash. A purpose of this invention is the provision of a combined receptacle and table which is adapted to be secured to the run-



THE DEVICE IN APPLIED AND EXTENDED POSITIONS

ning board of an automobile, the receptacle serving to house tableware and cooking utensils, the table when in extended position serving the purpose of a dining table.

VEHICLE BODY SUSPENSION.—W. D. HARPER, 7 Water St., Room 309, Boston, Mass. An object of this invention is to provide a construction and arrangement of parts which will permit a limited swing in all directions of the body on its supporting chassis. A further object is to provide means connecting the body and the chassis which will take up shocks and jars and prevent transmission of the same to the body.

AUTOMOBILE SIGNAL CASING.—S. GOLDSTEIN, 10 Stuyvesant St., New York, N. Y. The general object of the invention is to provide a signal for motor-driven vehicles, and more particularly with respect to the concurrence with which access may be had to parts for examination, repair, or removal, and to provide a signal that will be visible to those approaching at an angle as well as those directly in front or in the rear, the signals indicating that the vehicle is either about to turn or will stop.

DUMPING CAR LATCH.—A. M. FARRIER, 30 Church St., New York, N. Y. This invention relates more particularly to means for holding the car body in an upright position or locking the same in a full dumping or partially tilted position. A further object is to provide a latch which is automatically thrown by the car body as the latter moves to full dumping position to secure the car body in this position until manually released.

MANUAL CONTROLLING MEANS FOR VEHICLE SIGNALS.—E. G. BALCH, Elm St., Salisbury, Mass. Among the objects of the invention is to provide hand-operated setting and controlling means for signals, and it has particular reference to variable or changeable signal appliances for use in connection in, upon, or with vehicles such as automobiles, airplanes, or other land or water conveyances.

MICA LIGHT FRAME.—J. T. DENNIS, 307 Adams Ave., E. Detroit, Mich. The invention relates to frames for mica lights suitable for use with automobile curtains and similar fabrics. An object is to provide a metal frame which can be quickly and easily applied to an automobile curtain and which can be readily detached in order to permit replacement of a broken light.

DIRIGIBLE SPOT LIGHT.—N. GRINWIS, New Era, Mich. A purpose of the invention is to provide mechanism by means of which the spot light of a motor vehicle is rendered dirigible to allow of its adjustment so that its rays may be projected to any desired point. A further object is to provide mechanism which can be operated from a point interiorly of an automobile, thus rendering it applicable to closed cars.

ENDLESS RUNNER WHEEL.—J. H. KNAOGS, 319 Garden Ave., Coeur D'Alene, Idaho. The invention relates to a tread belt for endless runner wheels comprising a series of linked plates, with flexible members on the inner faces of the plates, bearings secured to the plates and clamping the flexible members between the bearings and the plates, and axles provided at their ends with flanged wheels journaled in the bearings.

WHEEL AND PULLEY REMOVER.—O. W. KELLEN, Fairbanks, Alaska. The invention has for an object the provision of a construction whereby a wrench or other small instrument may be used to quickly remove a wheel. Another object is to provide a removable device for wheels, keyed or otherwise locked, to live axles or shafts which latter is carried with the wheel and will permit the proper operation for removing the wheel at any time.

Designs

DESIGN FOR A CHALK SHARPENER.—J. P. PHILLIPS and N. C. AHL, 1537 N. Dover St., Philadelphia, Pa.

DESIGN FOR A PENNANT.—MILLIE W. HILLGARDNER, 85 Shellbank Place, Rockville Center, L. I., N. Y.

DESIGN FOR A DOLL.—RUTH H. USHER, 44 Hanson Place, Brooklyn, N. Y.

DESIGN FOR A HANDBAG FRAME.—J. FISCHER, address Marcus T. Goldsmith, c/o C. Y. Mfg. Co., 23 Marshall St., Newark, N. J. The inventor has been granted two patents for ornamental designs for handbags.

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Two Hundred Thousand Photographs Per Minute

(Continued from page 297)

ment of one whole prism. At the end of such movement the light ray is shifted back to the top of the frame, as the first bit of the new and unexposed film comes into the frame. The "shutter" in the Jenkins camera is simply the passing of the joint between the two ends of the "bar" prism, curved into the circular form.

Because of the simplicity of the mechanism, mechanical troubles in both camera and projector are at a minimum. The mechanism is simply a toothed sprocket to move the film, the usual take-up spool, and multiple-prism glass ring revolved synchronously with the movement of the film and the lens. Framing is accomplished by relative rotational advance of the sprocket ahead of the film. In practice a revolving slotted diaphragm works with the glass plate which bears on its edge the ground prism, in order to give the customary sharp edge to the picture.

Mr. Jenkins has made his ring prisms in two forms—one, described, in which the prism is on the edge of a plate of glass revolving across the field of light, and another, in which the prism is ground on the outer edge of a ring, with its axes approximately parallel to the theoretical axis of the circle. This circular ring of glass must be slightly tilted in use in order that the lens, which is in the center of the ring, does not pass the rays it receives through the ring again before they reach the screen. Curiously enough these two forms, though exactly alike in principle, do not give identical results, the ring form producing pictures less perfect than the plate form.

The British Fleet of Today

(Continued from page 290)

eign stations were allocated light cruiser squadrons, and, in the case of China, a flotilla of submarines. It was soon recognized, however, that this program, modest as it was by comparison with that of pre-war days, would have to be modified in deference to the urgent need of economy. The Home Fleet was the first to go. After being in commission only six months it was reduced on October 1, 1919, to a reserve basis, and a month later was abolished altogether. Shortly afterward the "Flying Squadron" of aircraft carriers was disbanded, all but one of its ships being paid off. On the other hand, a light cruiser squadron and a destroyer flotilla originally embodied in the Home Fleet were transferred to the Atlantic Fleet, which therefore has two light cruiser squadrons and four destroyer flotillas. In February, 1921, the battleship "Royal Sovereign" was paid off, its withdrawal leaving the Atlantic Fleet with only nine battleships in full commission. During the whole of last year the Battle Cruiser Squadron consisted of only the "Hood" and the "Tiger," the "Renown" being absent in Australia with the Prince of Wales and the "Repulse" undergoing a large refit. The "Repulse" has now been recommissioned, but the "Renown" has been placed in reserve, so that the present strength of the squadron is limited to three ships.

Although nominally in full commission the Atlantic Fleet today is not, in fact, on a footing of immediate readiness for active service. A substantial proportion of the ships' complements is made up of boys and young, untrained seamen. Naval officers have recently complained that so much time is taken up with training the personnel that few opportunities are left for evolutionary and tactical exercises. Moreover, in view of the unsettled political conditions in Europe and the Near East, it is useless to map out a training program for any length of time, as ships are liable to be detached at short notice for active service in one or other of the disturbed areas. For the greater part of last year the First Battle Squadron of the

Atlantic Fleet was detained in the Mediterranean owing to the menacing attitude of the Turkish Nationalists, and during the same period it was necessary to station a squadron of light cruisers in the Baltic in order to keep an eye on the Bolshevik forces. So far, at all events, the return of peace has brought no rest for the British Navy.

The Reserve Fleet makes a most imposing showing—on paper. Every naval port is congested with ships, nominally "in reserve," but actually with skeleton crews on board. Ships which scarcely more than two years ago were the pride of the Grand Fleet, now swing idly at their moorings, all but deserted. Beatty's famous flagship, the "Lion," now has only three wardroom officers on board, and others hardly less celebrated are in charge of "care and maintenance parties," which means a handful of men just sufficient to keep the machinery from rusting. At Sheerness, Portsmouth, and Devonport one may see long lines of destroyers, some launched as recently as 1918, apparently untended, and waiting passively for the word that will send them to the ship-breaker.

The actual strength of the British Navy in commissioned ships on the various stations in March, 1921, may be summarized as follows:

Home Station: Battleships—"Queen Elizabeth," "Royal Oak," "Resolution," "Ramillies," "Revenge," "Barham," "Valiant," "Warspite," "Malaya." Battle-cruisers—"Hood," "Tiger," "Repulse." Light cruisers—"Delhi," "Danae," "Dauntless," "Dragon," "Dunedin," "Caledon," "Carysfort," "Castor," "Cleopatra," "Cordelia." Destroyers—four flotillas, with a total of 72 boats, and the light cruiser "Coventry" as flagship of Rear Admiral (D). Submarines—Three flotillas, with a total of 21 boats. Miscellaneous ships—One aircraft carrier, one minelayer, eight depot ships.

Mediterranean Station: Battleships—"Iron Duke," "Emperor of India," "Ajax," "Benbow," "Centurion," "King George V." Light cruisers—"Cardiff," "Calypso," "Caradoc," "Centaur," "Ceres," "Concord." Destroyers—One flotilla with a total of 23 boats (including 3 with reduced complements). Miscellaneous ships—One aircraft carrier, seven sloops and gunboats (for service on Danube and in Red Sea), two surveying ships.

Gibraltar: Local defense flotilla, consisting of four destroyers.

East Indies Station: Light cruisers—"Highflyer," "Caroline," "Comus." Miscellaneous—Three sloops and an armed yacht. The flagship "Highflyer" is a very old cruiser, launched more than 20 years ago, and was recommissioned only because she is a healthy and comfortable ship in tropical climates. Her fighting value is negligible.

Africa Station: Light cruisers—"Birmingham," "Dublin," "Lowestoft." Miscellaneous—Two gunboats and a depot ship.

China Station: Light cruisers—"Hawkins," "Carlisle," "Colombo," "Cairo," "Curlew." Submarines—One flotilla consisting of 12 boats of the "L" class (of which 4 have no crews). Miscellaneous—21 gunboats and sloops, 4 depot ships.

North America and West Indies Station: Light cruisers—"Calcutta," "Constance." Miscellaneous—2 sloops. The new cruiser "Raleigh," now being completed, will shortly proceed to this station as a flagship, and it is expected that one of the three ships named will then be sent home.

South America Station: Light cruisers—"Southampton," "Dartmouth," "Weymouth." Miscellaneous—1 sloop.

New Zealand: Light cruiser "Chatham" and 1 sloop.

Australia: The only vessels of the Royal Australian Navy now in full commission are two light cruisers, six destroyers, six submarines, and several sloops. The battle-cruiser "Australia," 4 light cruisers, and six destroyers have

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only nucleus crews on board at present.

Canada: All vessels of the Royal Canadian Navy have been paid off with the exception of the light cruiser "Aurora" and two destroyers, which at present are in the Pacific, based on Esquimaux.

In June of this year a conference is to be held in London between the Premiers of the Dominions and representatives of the British Government, at which the whole question of future naval policy is to be threshed out. It is possible that, as a result of this meeting, the distribution of British naval forces on the foreign stations may be modified, but whether in the direction of increased or reduced strength cannot be forecast. If, as is anticipated, further economies in the naval budget are deemed to be necessary, the number of commissioned ships in home waters will be reduced. At the moment of writing it is considered probable that the Atlantic Fleet will be cut down to eight battleships, with corresponding reductions in the quota of light cruisers, destroyers and submarines.

The Current Scientific American Monthly

(Continued from page 291)

sounds. His study was initiated by the attempt to produce a pipe organ which would give vowel sounds, thereby assisting the choir and the congregation when singing. The article brings out many novel ideas; for instance, it shows that it is not particularly with relation to the form of the mouth but the larynx that distinguishes a Caruso from a costermonger.

Among the lighter articles is one on the manufacture of billiard balls, which should be of particular interest at the present time. In the field of natural history will be found a very interesting article on hornets and other useful wasps. This describes the nest-building and community life among these busy insects.

In addition to twenty-two leading articles and a large number of short articles and notes the current MONTHLY contains the usual departments devoted to scientific research and progress in the various fields of technology.

NEW BOOKS, ETC.

PLATINUM AND ALLIED METALS IN 1919. By James M. Hill. Washington: Government Printing Office, 1920. Paper 8vo.; 10 pp.

A Geological Survey report on the metals of the platinum group, with comparative statistics of production, trade, and consumption, stocks on hand Dec. 31, market and prices, and notes on home and foreign deposits and production.

WINGS OF WAR. By Theodore Macfarlane Knappen. New York: G. P. Putnam's Sons, 1920. 8vo.; 289 pp.; 44 illustrations.

There was a time when it seemed to us anxious outsiders that our ambitiously-planned aerial war fleet would "go up in smoke" that was not the smoke of the battlefield; and the Liberty engine seemed as near perfection as the perpetual-motion device. In "Wings of War," while mistakes and delay are by no means minimized, we have the thrilling story of how, from nothing, was built up a huge industry turning out 1,600 planes a month. The history and final triumph of the Liberty motor is told, and we find that, after all, our production of aircraft and equipment ranks as one of the most wonderful achievements of the war. All can understand and enjoy the book, and the student and technician will find in it much to reflect upon.

A CLASSICAL TECHNOLOGY. Edited from Codex Lucensis, 490. By John M. Burman. Boston: Richard G. Badger, 1920. 8vo.; 170 pp.

This transcription from an ancient Ms. holds great interest for the antiquary. It is followed by a careful translation and is further made intelligible by a glossary and pertinent notes. The subject-matter consists of old recipes for colors, inks, varnishes, welds, cements, alloys and compounds.

MACRAE'S BLUE BOOK, 1920. New York and Chicago: MacRae's Blue Book Company. 4to.; 1853 pp.

The steady growth in bulk and in popularity

of this buying guide is convincing testimony to its completeness and the convenience of its arrangement. The Address Section gives, alphabetically, 30,000 American manufacturers, with locations of branch offices and representatives; the Classified Material Section lists under 10,000 classifications the sources of supply for railway, iron and steel, building and other products; a Trade Name Index occupies a hundred pages; a Miscellaneous Data Section is for the benefit of all who specify or purchase; and this is followed by standard list prices of products, supplemented by tables for the instantaneous computation of discounts. "Look for the noun," is the slogan; and by listing such double-named items as "Water coolers" under the noun "Coolers," much space has been saved for the book, and much time for the consultant.

FUEL BRIQUETTING IN 1919. By F. G. Tryon. Washington: Government Printing Office, 1920. Paper 8vo.; 4 pp.; 1 illustration.

Production, value, raw materials, and number and location of plants are given in this Government bulletin.

COAL, IRON AND WAR. By Edwin C. Eckel. New York: Henry Holt and Company, 1920. 8vo.; 375 pp.; 9 graphs.

One thing alone would make significant this contribution of a geologist and engineer: it recognizes the fact that industrial development is largely a "phase of purely natural evolution." This recognition means a viewpoint more impartial than is customary. The facts, the material bases, and the causes and effects of industrial growth are impressively set forth, and the future of industrialism is discussed with insight. Those who believe the common weal is best promoted by methods neither too reactionary nor too radical will warmly endorse the ideas and conclusions here advanced.

A COURSE IN ELECTRICAL ENGINEERING. Vol. I. Direct Currents. By Chester L. Dawes, S.B. New York: McGraw-Hill Book Company, 1920. 8vo.; 496 pp.; illustrated.

Beginning with the simplest conceptions of magnetism and current flow, the text proceeds to describe and explain batteries, instruments and measurements, the generator, the motor, and the transmission and distribution of power. The work was undertaken in response to a demand for a plainly-phrased, comprehensive text covering the general field of electrical engineering. Figures and cuts, problems, questions and tabulations appear in abundance, and the student taking a course in this subject as a part of general training will find the exposition well within his capacity and understanding.

THE NATION'S FOOD. By Raymond Pearl, Ph.D., Sc.D., LL.D. Philadelphia and London: W. B. Saunders Company, 1920. 8vo.; 274 pp.; illustrated.

The need for better information on resources and consumption was made painfully evident to the author when he was Chief of the Statistical Division of the Food Administration. Finally the Division succeeded in acquiring a mass of the most valuable facts which, properly tabulated and arranged, are now available to all in this broad study of a paramount problem. No attempt has been made to interpret these facts; the author, to use his own words, is a hodcarrier delivering an abundance of carefully-made bricks to the specialist, who may build from them the structure he needs. It is a thorough survey of food resources on a scientific basis; the investigation keeps the nutrient factor well to the fore. This manner of presentation elevates the service far above "hod-carrying," essential as that may be.

CHEMICAL ENGINEERING CATALOG, 1920 Edition. New York: The Chemical Catalog Company, Inc. 4to.; 1,450 pp.; illustrated.

Almost every branch of industry has come to rely upon chemistry for important materials, tests, or processes; accessible information as to sources of supply has become an imperative need, and the popularity of this catalog, and its growth since 1916, demonstrate that its well-defined field of service has been intensively cultivated. Under the auspices of the leading chemical societies, it dispenses exact, full knowledge of the manufacturers of equipment and supplies, furnishes a classified directory of their products, supplements this by an information bureau, and, this year, offers a greatly enlarged list of more than a thousand technical books in English, with subject index. The condensation, standardization and cross-indexing show meticulous care and excellent results; all who use, buy, or specify raw materials, machinery or equipment for chemical processes of manufacture will find the information official and of inestimable benefit.

THE FUNDAMENTALS OF PHOTOGRAPHY. By C. E. K. Mees, D.Sc. Rochester, N. Y.: Eastman Kodak Company, 1920. 8vo.; 111 pp.; illustrated.

There is a natural curiosity in the mind of the beginner to know just what happens in the camera and the dark room to produce the finished picture. Repelled by the difficulty of finding the optical and chemical facts clearly and briefly expressed, that curiosity too often dies. Dr. Mees has come to the rescue with a lucid, pictorial account of actions and reactions, why and wherefore, that not only makes theory plain, but also contributes to practical success.

HANDBOOK OF COMMERCIAL GEOGRAPHY. By Geo. G. Chisholm, M.A., B.Sc. New York and London: Longmans, Green and Co., 1920. 8vo.; 666 pp.; illustrated.

The eight additions through which this work has traveled into the favor of educators witness its excellence. It recognizes intellectual interest as tending to material success in business, and imparts such interest to the facts in which it deals; high school and college will appreciate the new zest given to the lesson. Connected thought is thought retained; hence alkali, for example, is considered in its trade relationships to salt, sulphur, lead, etc. Commodities also appear under climatic groupings, while the maps show density of population, products and chief exports. The work is of British origin, but its value to our students of trade is no less than to their cousins across the sea.

BLUE PRINT READING. By E. M. Wyatt. Milwaukee: The Bruce Publishing Company, 1920. 8vo.; 86 pp.; 29 plates.

Mechanical drawing is treated as a universal language, with rules of grammar to be observed in writing and interpreting it. The course offers, not an expert understanding of drawing, but a working knowledge of fundamentals, conventions, shop sketching, and particularly of the interpretation of the working drawing. Detailed study of a set of house plans and of a bench grinder conclude the brief, helpful lessons.

THE ELEMENTS OF MARKETING. By Paul T. Cherington. New York: The Macmillan Company, 1920. 8vo.; 238 pp.; illustrated.

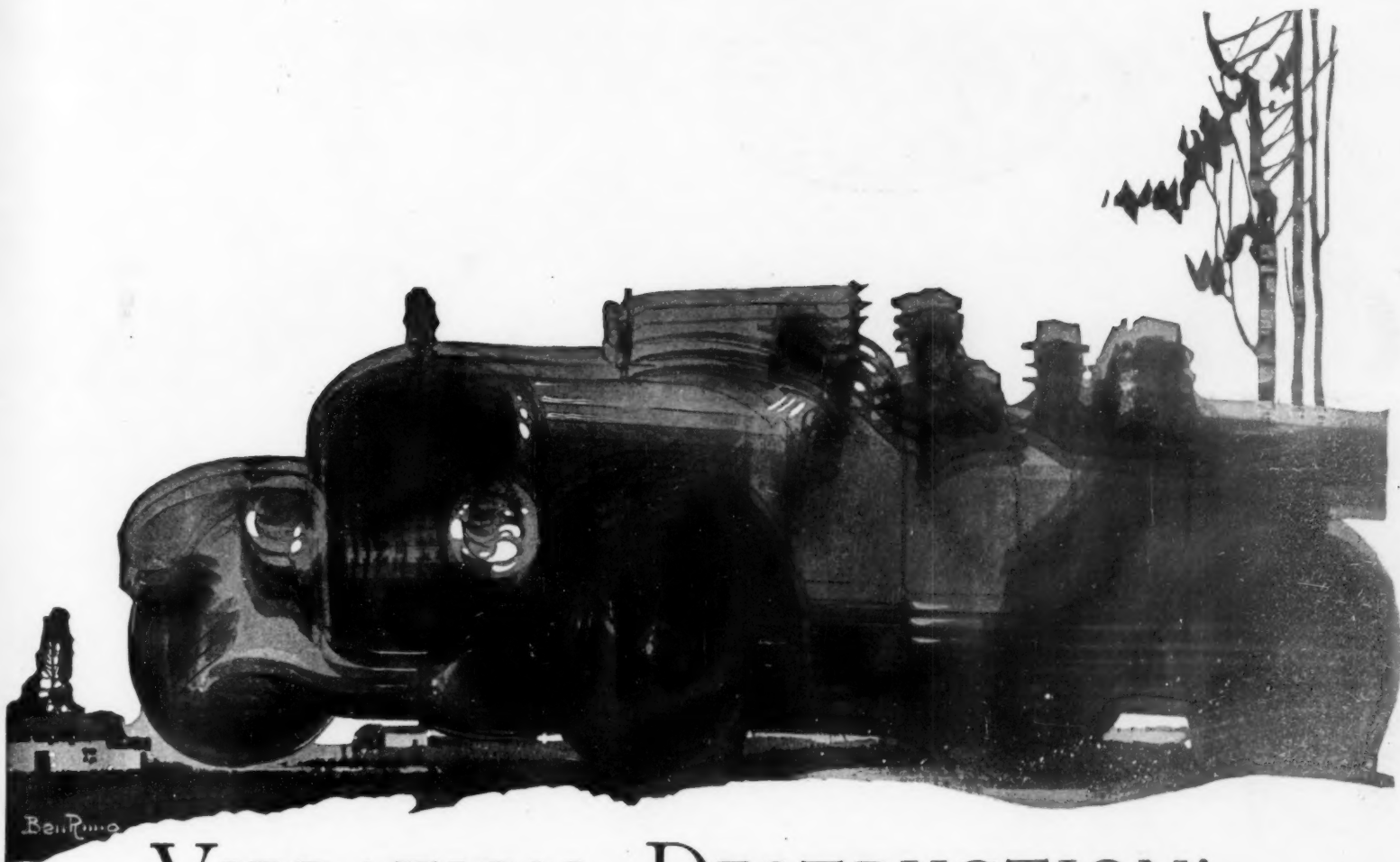
If the student has a fair grasp of economic principles he should find no difficulty in mastering this course, which is confined to the practical problems of merchandise distribution. Marketing functions—assembly, grading, storing, and transporting—are discussed constructively; financing, risks and sales in their relations to equipment, personnel, and the public are studied; and there are chapters on the components of a retail price and the costs of distribution. It is a well-rounded presentation by a thoroughly qualified instructor that goes to the gist of the matter in a welcome manner.

THE SYSTEM OF ANIMATE NATURE. By J. Arthur Thomson, M.A., LL.D. New York: Henry Holt and Company, 1920. 2 volumes; 8vo.; 687 pp.

A new book by this distinguished naturalist is an event worth celebrating; and there is no better way of celebrating it than by partaking of the banquet he has himself provided. All animate nature has been canvassed to provide this feast, and scientist and layman may sit together at the board and take their enjoyment. The pessimistic conclusions of the past century are shown to be largely the result of malassimilation of facts; under the author's logical manipulation, the subtler phenomena of nature take on new significance. All who are interested in biological and psychological evolution may read and understand this luminous story of man, his place in the universe, and his hope for the future. It is philosophy at its best, with its feet on terra firma and its gaze courageous, keen and sane.

THE AMERICANIZATION OF EDWARD BOK. An Autobiography. New York: Charles Scribner's Sons, 1920. 8vo.; 461 pp.; illustrated.

At the age of six, a poor Dutch boy was brought to this Promised Land. His arduous efforts to help his parents might easily have resulted in intellectual stultification, but the Bok boy had ideals. He forged ahead, developed his mind, caught and kept a broad view of life, and finally became editor of *The Ladies' Home Journal*, making it an instrument of educational value in the home. His life has brought him in contact with six of our presidents; with Emerson, Longfellow, Stevenson, Kipling, and other noted authors; and with such celebrities as Jay Gould, Henry Ward Beecher, and Gladstone. It is one of the autobiographies that old and young may delight in and profit by.



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